33rd YEAR

CHEMICAL WEEKLY

VOL. XXXIII JULY 26, 1988 NO. 46

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CHEMICAL WEEKLY

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The National Coal Scenario - I

ANNUAL REVIEW (1987-88)

Coal has been recognised as the most important source of primary energy in the country. No meaningful programme f power generation, can be thought of, in the country, without oal, in the foreseeable future. Coal is also, an essential input for ome other infrastructural sectors of our economy, like steel, cement nd fertilizer.

The year 1986-87 witnessed a record coal production of 166.79 illion tonnes (MT), registering a growth of 7.5% over 1985-86.

The country's coal requirements for the final year of the Sevnth Plan period (1989-90) which had earlier been assessed at 37 MT, had to be pruned down to 221 MT. This slackness in emand is attributable to the downward trend in international crude il prices, deteriorating coal quality and the perennial transport botneck. Of the anticipated reduction in demand, the share of the ower sector is 11 MT, and that of steel and railways and fertisers 5 MT 1.5 MT and 1 MT respectively. The cement sector expected to retain the present demand of 92.6 MT and it is only ne miscellaneous sector where the demand is expected to rise y 3 MT.

Coal is one of the few commodities, which has witnessed a teady uptrend in demand through all the plan periods. The Sixth lan witnessed an annual growth rate of 7.2 per cent and the Sevnth Plan as yet may record 8 per cent. As in previous years, the ncreased output is likely to be met largely by open cast mining nd to a much lesser extent by new technology.

The coal production for 1987-88 touched a new record of 181 illion tons. (7.5% over 1986-87) Coal India (comprising Eastern, Western Coal Field and BCCL) accounted for 88% (141 M.T.) of ne output (increase of 1 MT over the target), Singareni Coalfields 15.3 MT) (9.5% increase) a shortfall of 1.5 MT and others TISCO, SCO and DCC, balance (3.88 MT — shortfall 0.5 MT).

Of Coal India's production of 159 MT, 96 MT (increase of 18 MT over 1986-87) came from open cast mines, and the rest 63 MT from underground mines. The same pattern held good with respect to Singareni Coalfields as well.

The overall productivity rate, the output per man shift (OMS) is still below one tonne; the open cast mines record OMS of 2.6 tonnes and the underground 0.5 tonnes per man shift, the latter recording a slight decline in the rate. The productivity at Singareni Coalfields presented a brighter picture of 4.7 tonnes for open cast and 0.65 for underground.

This industry claims credit this year for having met the demand in full for all sectors. The total demand of 178 MT as against a production of 181 MT resulted in pithead stocks mounting to 28.0 MT. The pithead price of coal continues to be fixed by the Central Government under the Colliery Control Order (1945).

The ruling price of coal had been fixed in January 1986 at Rs. 183 per tonne. On the basis of a recommendation by the Bureau of Costs and Prices to raise the pithead price to Rs. 240 per tonne, the Government fixed the average price effective from 23rd December 1987 at Rs. 219 per tonne.

The tragedy of mounting losses of the nationalised coal sector lies in the fact that from 1974-75 todate, the wide gap between the administered selling price of coal and the actual cost of production has been persisting and widening. The gap between the two which was around Rs.9/tonne in 1974-75, widened to Rs.25/tonne in 1985-86 and is expected to touch Rs.35/tonne in 1988-89. The total accumulated losses as on March 18, 1987 has touched the staggering figure of Rs. 2033 crores.

The salaries and wages, followed by stores and depreciation continue to be the major cost components of the per tonne production cost. During the year 1987-88, the actual cost of production worked out to Rs. 239.54 as against Rs. 219.17 in 1986-87. Of the above 45% is spent on wages, 13.7% on stores, 9.4% on depreciation, 7.7% on interest, 6.8 on power, 4% on administration, 2.86 on transport and 10.6% on miscellaneous expenses.

Coal represents a major source of revenue to the producing States. The average royalty paid by the Coal Companies to the State is about Rs. 4.50/tonne and Cesses of various types amount to about Rs. 13.00 per tonne.

The performance of this crucial sector of national economy continues to be afflicted by numerous constraints. The loss of production of Coal India due to various factors is estimated as under; non-availability of power 4%, absenteeism (2%) excessive rains and flooding 1% and other factors, all totalling to about 10%.

The production of Coal is only half the job done. The other half and perhaps the more important one, is to reach the coal to the consuming points at the right time and with the right properties. This job is achieved by a combination of transporting agencies, namely railways (67%), roadways (11%), merry go round systems (10%), and others like ropeways, belt conveyors, rail cum sea route carriers (12%).

The Railways constitute the major system of coal transportation (67%) and coal is the largest single commodity transported by the railways, constituting about 42% of the total rail goods traffic. The Railways transported 119 M.T. of Coal and Coke from Collieries and washeries during 1986-87. The target for Rs. 1987-88 had been fixed at 125 M.T.

The road transport of coal for the past three years has been hovering around 40 MT, contributing significantly to avoidable consumption of high speed diesel oil besides adding to the environmental pollution.

Coal requirement of some of the consumers in South India is met by the rail cum sea route to obviate the difficulties experienced in the rail movement to distant destinations from Bengal-Bihar Coalfields. Requirements of Tuticorin and Ennore power stations of Tamil Nadu are met in full by this route. At the forwarding end, Haldia, Paradip, and Vizag ports handle the shipment which averages roughly 4 lakh tonnes per month. Export of coal from India is channelised through the Mines and Mineral Trading Corporation, the traditional buyers being Nepal, Bangladesh and Bhutan. Since 1984-85, a small quantity of special low volatile coal (SLV) is being exported to South Korea. The total exports are under two lakh tonnes per year.

About 88% of the total coal output of the country is accounted for by Coal India Ltd., and naturally enough, Coal India is the biggest supplier of coal to various consuming sectors of the economy. The daily average coal loading in CIL during 1986-87, was 11,288 wagons/day. The corresponding figure for the first 9 months of 1987-88 was 11,389.

Consumer complaints on coal quality relate to supply of coal of lower calorific value, presence of extraneous mineral matter, supply of oversized coals, and short receipts. With a view to obviate at least some of the complaints, coal handling plants (CHP) and screening plants have been installed at suitable locations. The capacity of the CHPs at the end of March 1987 stood at 93.98 MT and 2.3 MT capacity has been added during 1987-88. 70% of the coal produced today passes through CHP and by 1990-91, the entire quantity is expected to pass through CHP.

To overcome the complaint of short receipt, as many as 79 weighbridges with electronic print out facilities (9 of them during 1987-88) have been installed.

At present 14 washeries for beneficiating coking coal are working under Coal India. Eight of these washeries — Dugda I & II, Bhojudih, Patherdih, Lodna, Barora, Sudamah, and Moonidih beneficate prime coking coal, and are under BCCL. Six washeries viz. Kargah, Kathara, Sawang, Gidi, Rajrappa and Nandan beneficate medium coking coal and are managed by the Central Coalfields. Nandan Colliery is the first coking coal washery operated by Western Coalfields Ltd.

Besides the above-mentioned washeries of Coal India, the Steel plants have four captive washeries, Chasnala of Indian Iron, Jamodola, and West Bokaro of Tata Iron, Durgapur washeries of Durgapur Coal. The clean coal production is hovering around 10 MT for the past several years against a production of 25 MT of coking coals. Proposals for the washing of non-coking coals are pending execution. India is the only country among developed and developing nations beneficating less than 10% of the total coal output.

The Singareni Collieries Company Ltd. (SCCL) has been meeting the coal requirement of prime consumers in South India. Due to concerted attempts by the concerned authorities the coal production started improving from 1985-86, to reach the figure of 15.66 MT against 12.33 MT in 1984-85. The figure further improved to 17 MT in 1987-88. This group of collieries effected a daily wagon movement of 1400 wagons.

The soft coke production has been declining over the years, primarily due to the unremunerative prices and the lack of appropriate technology to achieve optimum yields and acceptable quality.

Coal India's production of hard coke during 1986-87 was 5.84 lakh tonnes but the output for 1987-88 is about 5 lakh tonnes only. The brightest spot on the national coal scene continues to be presented by the Neyveli Lignite Corporation which nearly fulfilled the target of 96.5 million tonnes of lignite, 5800 million units of power, 1,18,000 tonnes of urea and 228,000 tonnes of coke briquettes.

The national coal scene is certainly nothing to enthuse about but on the other hand it does offer enough evidence of its capabilities to fulfil its role of continuing and being the major provider of the nation's energy needs in the years ahead.

-- T.P.S. Rajan.

CHEMARENA

S.L. VENKITESWARAN

Japan — USA move Towards Co-operation in Chemicals

(Basis *C.E.NEWS*, 11.4.88)

Japan and USA had gone to war and a defeated and devastated Japan was helped to rebuild by a generous US Administration and an iron-willed Administrater Gen. Macarthur. Not only was Japan helped to move up rapidly in the post war era with spectacularly high growth rate but Japan was also guided into a democratic setup with a figurehead king. The self-imposed restraint on arms enabled Japan to concentrate and build-up a Civilian-Industry Complex unlike the large segments of Military Industrial complex of USA and other countries. Japan's Ministry of Industry and Trade, a very comprehensive set-up of talents, helped and guided the efforts based on liberal import of technology in chemicals. The self-discipline and work ethic of the Japanese enabled them to make maximum exploitation of the imported knowhow and develop them further to a position of superiority while Japan's own research and development efforts came in later to assume a position of dominance in several areas. The position of Japan is of a world leader in automobiles, computers, cameras, electronics, steel, heavy machine and ship-building and many other areas. The case of chemicals is also one of dominance in some sectors such as biotechnology and equal competence in most commodity chemicals. But now Japan is said to be moving ahead of USA in more areas such as high-tech ceramics and biotechnology, that the US Government has for some time been keeping track of Japanese developments by technical missions posted in Japan. Now there are moves towards an integrated future through joint industrial ventures, shared research and technology exchanges. Japan is also taking over some units in USA or starting from scratch to build production centres in USA.

US Government has been seriously concerned over massive trade deficits with Japan for years running — of the order of $ 20 billion in high-tech products of a total of $60 billion in 1987. In chemicals US has a surplus in trade all the time but a linkage in technology would help to improve this and counter Japan's hegemony elsewhere. There is also intense pressure for liberalisation in Japan for US investments and exports —to work out a more liberal and balanced relationship. Japan spends less than half of what USA does on R & D. Japan is far less bothered about basic research and more on capitalising on the efforts of others in basic research.

How US and Japan rate in key research areas is indicated in Table 1. A sampling of collaborations of US Companies with Japanese firms is in Table 2. The trend to obtain technology from Japan has been growing and emphasises the need for a US shift in policy towards cooperative research efforts.

Japan has been moving to a more coordinated effort with US through steps such as:

a) For international research ventures and a Human Frontiers Programme particularly in molecular biology and immunology.
b) Cooperation between Corporations of the two countries for development and marketing.
c) Interest of US personnel and corporations on how Japanese manage the technology and derive benefits.
d) Co-operation in advanced military technology where Japanese advances in high-tech materials are very useful.
e) Efforts to co-ordinate work on the emerging field of super-conductors, where Japanese expertise in practical applications or novel innovations would be helpful.
f) Move towards greater versatility of the top staff as in Japan as against over-specialisation in limited areas in USA.
g) Move towards concensus building in decision making, a "bottom-up process", wherever possible.

If the 21st century is going to be of Technopolicies, surely Japan will be the pioneer and USA wants to be equally in the front. Today "Technology is driving Science" but there is said to be a lot of basic science on the shelves which can promote technology, an area where Japanese are on top. For the present it is reported that US and Japan have agreed on several specific areas for mutual collaboration in target technologies.

The move is between Corporations of the two countries. Subjects like biotechnology (other than recombinant DNA), engineering plastics, high-tech ceramics, membrane separations are some of these areas. Diffusion of technology and crosslicensing will be the direct result of co-operative research. The togetherness of USA and Japan in high-tech areas spells trouble for others in the near future.

Table 1

HOW US AND JAPAN RATE IN KEY RESEARCH AREAS

Substance and Materials:

U.S. leads in:
- Performance under extreme conditions.
- Surface boundaries.
- Theoretical design techniques.
- Theories of reaction for synthesis.
- Compounding materials.

Japan leads in none of the areas designated.

Electronics:

U.S. leads in:
- Molecular electronics.
- Bio-electronics.
- Artificial intelligence software.

Japan leads in:
- Optoelectronics

Life Sciences:

U.S. leads in:
- Design and synthesis of functional proteins.
- Micromanipulation of DNA and chromosomes.
- Cell manipulation.
- Brain mechanism studies.
- Immunology.

Japan leads in none of the areas designated.

Production and Processing:

U.S. leads in:
- Computer software.

Japan leads in:
- Robotics
- Very large scale integrated circuits.
- High-precision work

Both are about even in:
- Computer hardware.

Table 2

SAMPLING OF COLLABORATIONS OF US COMPANIES WITH JAPANESE FIRMS

CHEMICALS:

Hercules/Sumitomo Chemical: Sumitomo licenses conductive elastomer technology for keyboard data entries.
Diamond Shamrock/Showa Denko: joint venture to produce agricultural chemicals and veterinary drugs.
Du Pont/Nissan Chemical Industries: Du Pont uses Nissan's high-density polyethylene technology to develop third-generation HDPE resin.
Olin/Kanegafuchi Chemical Industry: Olin licenses ion exchange caustic soda technology.
Air Products & Chemicals/Daido Sanso: Daido serves Air Products markets in Pacific region.
W.R. Grace/MTP Kasel: Joint venture to produce and market variety of Chemicals, including soundproof materials, rust preventives, and adhesives.
Celanese/Nippon Shokubai: Joint venture to develop synthesis-based processes for petrochemicals.

PHARMACEUTICALS/BIOTECHNOLOGY:

Bristol-Myers/Kyowa Hakko: Bristol-Myers licenses rights to develop and sell anticancer drug mitomycin C.
Abbott/Hokuriky Seiyaku: Abbott licenses bronchodilator, Bremax.
Merck/Yamanouchi Pharmaceutical: Merck licenses urinary infection antibacterial Noroxin.
Merck/Torli & Co.: Merck acquires majority interest.
Genentech/Kyowa Hakko and Mitsubishi Chemical Industries: Joint venture to produce tissue plasminogen activator using Genentech methods: Japanese firms to provide financing and do clinical trials.
Schering-Plough/Yamanouchi Pharmaceutical: Yamanouchi licenses — interferon manufacturing technology.
Genex/Green Cross: exclusive 15-year license for Green Cross to market Genex's human serum albumin from microbial strain.
Genetic Systems/Dai-Ichi Pure: Exclusive rights for Daiichi to sell for research only certain Genetic Systems monoclonal antibodies.

UP drug policy bent

The drug purchase policy of the Uttar Pradesh government has been tailored to benefit the government owned U.P. Drugs and Pharmaceuticals Ltd. (UPDPL), in contravention of the Centre's directives, according to a report published in The Times of India.

Since the state medical and health secretary happens to be the ex-officio chairman of the UPDPL, drug purchase rules framed by the government are invariably aimed to suit the company However, this time the state government seems to have gone a step further by violating the Union government's orders.

By an order of the department of chemicals and petrochemicals of the Union industry ministry of February 2, 1988 restrictions have been imposed on manufacture of drugs under the loan licensing system. As such, a total ban had been imposed on manufacture of drugs by loan licencees in the private sector for any public sector company.

Public sector pharmaceutical companies were authorised to get medicines made under the system only from other public sector units only when their market demand was more than their production capacities.

The UPDPL has been known for issuing loan licences to private manufacturers and the central government's order would mean a blow to the "unholy" alliances between the two.

Since the Union government's order would deprive the UPDPL officials of the "under-the-table" benefits got from determining the licencee, they sent an SOS to the state government, which came to their rescue.

Through an order of June 9, the state government directed the director-general of medical and health services, Dr. Gupta, to exempt the UPDPL from the earlier order of August 30, 1985, whereby a ban was imposed on the loan licensing system of public sector undertakings. However, no mention of the Union government's order was mentioned.

Dr. Gupta, in a letter to the medical secretary, Mr. Mohinder Singh, has pointed out that the UPDPL has gone to the extent of issuing loan licences for drugs it never manufactured and also for which it never had manufacturing licences.

Although the letter was sent a month to give a reply, thus delaying the process of drug purchase.

It is alleged that the dilemma that holding back the decision of the medical secretary is due to the perquisites he enjoys as ex-officio chairman of the UPDPL.

The state government, too, has been keeping its eyes closed to the glaring discrepancies in the rate charged by the UPDPL for its products. Despite an affidavit filed by the company before the additional director of Central Medical Stores Department (CMSD) that the rates quoted by it are not more the market rates for the same drugs, investigations have revealed facts to the contrary.

At least nine important drugs, including some life-saving ones, are being sold by the UPDPL to the CMSD at a rate substantially higher than that charged from the Employees State Insurance (ESI) department. For example, while a pack of 1,000 ampicillin capsules of 250 mg is being quoted at Rs. 735 to the ESI, the CMSD rates is Rs. 900. Likewise, tetracycline capsules in the same pack are sold at Rs. 350 to the ESI while the CMSD charges Rs. 450. In some other cases the difference in the rates is even more.

CRUDE PRICES JUMP

Oil prices leaped in response to news of a possible ceasefire in the Iran-Iraq war, posting their biggest one-day increase since March 1987.

The news raised prospects that the Organisation of Petroleum Exporting Countries would be able to calm its chronic infighting, which has led to overproduction and lower prices.

The jump brought prices back to their levels of earlier this month, before a steep skid in prices took hold because of concerns about a worldwide over supply of oil.

On the New York Mercantile Exchange, the August contract for West Texas intermediate, the benchmark US crude oil, shot up 84 cents a barrel to settle at $ 15.70 a barrel. That was the biggest one-day rise since one of 96 cents a barrel on March 3, 1987.

Rally 'overdone' :

Analysts in London cautiously warned that the rally in prices may have

Iran's unconditional acceptance of the resolution was viewed by the market as constructive as it increased the prospect of an end to the Iran-Iraq war, which would enable Iraq to re-enter OPEC's production quota accord.

The possibility Iraq could re-enter the accord pushed crude oil prices sharply higher, with brent blend physical crude for September reaching a peak of $ 15 per barrel, up about 70 cents on July 15.

However, most analysts were sceptical as to whether the rally could be sustained, saying it was too early to accurately evaluate the implications to ceasefire news for oil prices.

The market viewed the news as bullish because the Iran-Iraq conflict has been "OPEC's Achilles, heel" and with an end to the war in sight, the market thought OPEC's problems could be resolved.

However, analysts doubted whether an end to the war would solve OPEC's problems.

There are few reasons to believe that an end to the war would result in a reduction in oil production from either Iran or Iraq. Both countries would wish to rebuild their economies and Iran in particular would concentate on rebuilding oil installations damaged in the conflict, analysts said.

SEYCOFILM PF230 INCREASES WEAVING EFFICIENCY

Indokem Ltd. (A Khatau Enterprise) has started marketing various products, manufactured in India in collaboration with M/s. Seydel International USA (World Masters in Sizing). SEYCOFILM PE-230 is the first product introduced successfully in Textile Mills after this collaboration. SEYCOFILM PE-230 is a resin of low viscosity with chemical characteristics which bind starch and other ingredients very strongly to polyester/cotton fibres. Its excellent affinity to polyester and very low cost as compared to PVA (the conventional binder being used for sizing of Polyester/Cotton blends), has made it a very popular sizing adhesive in its short span of introduction. SEYCOFILM PE-230 size mixings give excellent protection to yarn and have significantly increased weaving efficiency in several shuttleless weaving operations.

Further information can be had from: Indokem Ltd., Udyog Mandir Compo-

Polymers for Rs. 380 Cr. to be imported

In view of a critical shortage of polymers in the country, the Department of Chemicals and Petrochemicals in the Ministry of Industry has tied up import of 270,000 tonnes of different types of polymers for the remaining nine months (July-March) of the current financial year 1988-89. This is in addition to an import of 48,000 tonnes of polymers already made in the first quarter (April-June) of 1988. The total imports are valued at Rs. 380 crores in free foreign exchange.

Speaking to presspersons in New Delhi on July 19, Mr. H. K. Khan, Secretary, Department of Chemicals and Petrochemicals, said the domestic production of polymers had increased from 2,72,000 tonnes in 1984-85 to 2,85,000 tonnes in 1987-88 despite the closure of two LDPE plants of Union Carbide India Ltd. and ICI. While additional capacities for the manufacture of polymers are being established to provide a long term solution, the immediate way to cover the domestic shortage was through imports.

According to Mr. Khan, the Government had deputed two delegations to discuss and tie-up the supply of polymers to India. The delegation which has since returned met 41 major suppliers and producers of polymers in the world. Following this it has now been decided to import different types of polymers to the extent of 132,000 tonnes from sources in South East Asia, 50,000 tonnes from Western Europe, 42,000 tonnes from Latin America and 30,000 tonnes from Middle East countries.

Domestic availability

Against the demand for various polymers in India, estimated between 650,000 tonnes and 700,000 tonnes, the domestic availability is expected to be around only 350,000 tonnes. Thus, the import of nearly 318,000 tonnes in the current financial year is likely to meet a substantial part of polymer demand in the country. Additionally, the two delegations have also received assurances from the producers abroad for supply of 340,000 tonnes of different types of polymers for the next financial year 1989-90.

Mr. Khan said the Maharashtra Gas Cracker Complex was likely to be commissioned by mid-1990 and with that the domestic production of polymers would go up by another 300,000 tonnes. Despite a doubling of domestic production, the demand for polymers in India was likely to outstrip the supply. To cope with the future demand projections, Mr. Khan said it was necessary to establish additional cracker complexes with downstream units for production of polymers. Similarly, additional aromatics complexes will need to be set up to meet the future requirements of fibre intermediates.

In the case of aromatics complex, already a letter of intent for the manufacture of 150,000 tonnes of PTA has been issued to the Madras Refinery Limited and it is also proposed to set up another unit in Saleempur in Uttar Pradesh.

Two more complexes:

The Government also proposes to set up two more gas cracker complexes at Hazira in Gujarat and Visakhapatnam in Andhra Pradesh. Four multinational giants — Shell of the UK, Mitsui of Japan, Linde of West Germany and British Petroleum of the UK — have submitted to the Indian Government attractive proposal for investment in the petrochemical complexes being set up in the country.

In addition, the World Bank has shown interest in financing the Hazira cracker complex to be set up in Gujarat in the joint sector.

While both these developments indicate the inherent attractiveness of investment in Indian petrochemicals projects, the existing domestic units in the petrochemicals industry have made a dent on the export market. During 1988-89, they hope to fetch foreign exchange worth over $ 110 million through exports of polyester staple fibre (PSF), synthetic woven sacks and linear alkyl benzene (LAB).

According to a spokesman of the Department of Chemicals and Petrochemicals all the investment proposals are for equity participation in the complexes. The Government is examining all the proposals as also the World Bank offer of the Hazira complex.

Both Shell and British Petroleum of the UK have shown interest in investing in the equity of the company that will implement the Hazira cracker complex. But the two companies are willing to consider investing in any other petrochemical complex, if the Government cannot accommodate them in the Gujarat project.

The Hazira complex, it will be recalled, is likely to be set up in the joint sector with Reliance Industries Ltd and Gujarat State Fertiliser Corporation (GSFC) as the partners. The World Bank has also offered assistance to the project. Thus the association of the British companies would, to some extent, be dependent on the World Bank and the Indian promoters.

Mitsui of Japan has indicated its desire to invest in the cracker complex, to be set up at Visakhapatnam. Here also the offer is for equity participation. The likely Indian partner for this project will be the State-owned Indian Petrochemicals Corporation Ltd., (IPCL), which has already applied for a letter of intent for this project.

Linde of West Germany has not shown any particular preference for any petrochemical project. But its proposal to the Indian Government indicates that it is ready to invest in the equity for any of the petrochemical project to be set up in the country.

Panel formed :

A committee has also been set up under the chairmanship of Mr. J. J. Mehta, former chairman of the IPCL, to work out the economic feasibility of either setting up a joint venture in Saudi Arabia and Algeria for the production of ethylene and polypropylene or import the raw material and do the processing in India.

Referring to polymer imports contracted for the current financial year, Mr. Khan said LDPE and LLDPE would account for 79,000 tonnes. Of this, Yugoslavia will account for 15,000 tonnes. This is a critical raw material used in milk packaging, etc. The imports of HDPE will be 63,000 tonnes, polypropylene 15,000 tonnes, PVC 100,000 tonnes and polystyrene 6000 tonnes. While LDPE, PP and PS would be imported by IPCL, HDPE and PVC would be imported by the STC. With the current international prices ruling high for varieties to be imported by the IPCL, it has been decided to supply these varieties of polymers throughout India on the basis of a uniform pool price. In the case of the STC, the prices would only include

RTILISER FROM JAPAN

Govt. notifies import licensing conditions

The government has notified licen- g conditions for the import of fer- ser from Japan under the grant aid 600 million yen for 1987-88.

The aid is intended to be used for ancing payments to Japanese sup- ers for import of fertiliser (diammo- m phosphate — DAP) and services uired for its transportation to ports India.

The import of fertiliser is covered der open general license, according a public notice issued by the chief ntroller of imports and exports on y 6.

The contract should provide for ment on cash basis — on presen- on of shipping documents by the anese supplier to the Bank of India. kyo. It should also provide for the iod of delivery which has to be npleted by March 15, 1989.

The contract value (cost and freight is only) should be in yen and uld exclude the Indian agent's mmission. Under no circumstances, uld the contract value be expressed any other currency, it has been down.

The fob cost and freight amount uld be shown separately but it uld be clarified in the contract it- whether the freight will be payable actual basis or whether the freight rges indicated would be the amo- payable irrespective of the actual rges.

The purchase contract has to be in ordance with the agreement bet- n the governments of India and an signed on April 21, 1988, rela- to the grant aid of 600 millon yen 1987-88.

ayments to the suppliers will be le through an "authorisation to " which will be issued by the con- er of aid accounts and audit, in- ministry of finance, New Delhi, avour of the Bank of India, Tokyo, er the Japanese grant aid it is ed.

NS OF BREAKDOWN OF OPAL GAS VICTIMS' IMMUNE TEMS

he immune systems of the Bhopal leak victims are beginning to show signs of breakdown that could affect them just like AIDS patients, a British doctor has warned.

"Immunity has to do with what is resistance and this response seems to be decreased," Dr. Neil Anderson, an eye specialist who has been working among victims of the methylisocyanate (MIC) gas leak, said over Independent Television (ITV) on July 18.

"I am not saying MIC is like AIDS. I'm just using that as an explanation of what the implications would be if the immune systems were damaged."

Dr. Anderson, who was sent to Bhopal by the Royal Commonwealth Society for the Blind and has been carrying out research with MIC in Britain, bases his conclusion on an increase in cataract cases among those exposed to MIC, ITV said.

"In the third year of follow up, we found a fairly convincing excess of infections and that excess is worse among people who were worse exposed," said Dr. Anderson, who has also been working alongside Indian doctors in Bhopal.

"There is a very strong suggestion that people who were exposed get more mild cataracts. We don't know what will happen to those people — whether they will go on to a more severe form of cataract..."

"What is very important is the speed at which they develop. We are seeing them develop rather quickly."

Dr. Anderson said his experiments with animals had proved that MIC caused damage beyond the eyes and the lungs. "The liver is very badly affected, the spleen is very badly affected, — related to dose and getting worse over time. Finally, the kidney seems to be quite severely affected — worse in animals that have had more exposure — and something which doesn't get better. It seems to get worse.

Over 2000 persons died and several thousands were affected when MIC gas leaked from Union Carbide's factory in Bhopal in December 3, 1984.

D. O. P. KHARBANDA

Frankly Speaking

Carbide's Cheap Trick

O. P. KHARBANDA, Cost & Management Consultant,
501, Olympus, Altamount Road, Bombay-400 026.

(Dr. Kharbanda, a Fellow of the Institution of Chemical Engineers, is a visiting professor and an author of repute. His latest title: SAFETY IN CHEMICAL INDUSTRY, 320 pp was released by Heinemann in London, May 3, 1988 He consults worldwide including to UNIDO.)

When? May 10 1988. Where? London. Who? Arthur D. Little (ADL), Spokesman: A. S. Kalelkar, Sr VP ADL. What? Jury verdict without a trial. How? Matter being subjudice, Carbide spoke through ASK/ADL.

The event? A 3-day international symposium, May 10-12, 1988 organised by The Institution of Chemical Engineers, UK in association with The American Institute of Chemical Engineers (Centre for Chemical Process Safety), The World Bank and others. In effect, a high-level technical conference attended by over 400 delegates from more than 20 countries. The theme? PREVENTING MAJOR CHEMICAL & RELATED PROCESS ACCIDENTS. Naturally, Bhopal dominated the entire conference but its case history taken up on the very first day, shocked the participants and even the organisers. I was an invitee-member of the panel, other members being J. Gittus, Director, Communications & Information, U.K. Atomic Energy Authority and S. Poltorsycki, ADL, USA. But, thanks to this session chairman, T. W. Carmody, a former executive of Union Carbide, the entire 'show' was so engineered that there was no panel and no discussion, the time allotted for these was given, before hand, to ASK. It was a pity that a technical discussion on a subject as vital as Bhopal, became a PR exercise for Carbide. Vital? Bhopal has been by far the worst ever industrial disaster, and it is a landmark we could well have done without. Chemical industry would never be the same as before Bhopal, which struck such a severe blow to the image of the industry that the slogan:

Better things for better living **through chemistry** has since been bereft of the last two words.

It was clear that the British hosts were not only shocked but even embarassed. ADL/UCC chose to use the international technical event platform for their narrow political and legal ends. They had abused the hospitality of the British hosts who, however, graciously explained that the session was allotted to AIChE, who should have known better than to lend their name and image to debasing an otherwise top event of the world relating to safety. I hope that the host Institution will, to show its concern, be bold enough to omit this paper from the final proceedings. After the ADL presentation, a Scandinavian delegate sitting next to me asked: 'What do you think of that?' I said 'It sounds like a cheap . . . . ', and he was quick to add the right word 'trick.'

The matter being subjudice, UCC chose to stay in the background and let 'their' story be told through a consultant duly paid for the job. UCC officials were, however, present at the conference in good strength, and according to the press reports, they took the lead at the press conference. The paper claims to present the 'facts' and draws the 'sabotage' conclusion. Significantly, ADL's paper does not even mention the serious basic design defects and management lapses on the part of the company, as documented in various investigative reports appearing not only in the Indian but also in the respectable (e.g., New York Times and the Amer Chem Society's Chem & Eng News) foreign media.

In retrospect, Bhopal was inevitable, the only question was: when? The very few and inadequate safety devices remained 'silent' witnesses to the disaster. None of them were in working condition on the night of Dec. 2, 1984, when almost the whole city was turned into a deadly gas chamber. A man-made tragedy !

The results of ADL's 'research' reminds me of an economist or a statistician, faced with a host of conflicting data, asking:

What is it that I want to prove?

A lawyer, even when defending his client-murderer, opens his case by stating, 'the facts are . . . .', well knows that 'facts' are what he 'fabricates', knowing of Einstein's famous statement:

The facts are wrong.

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Pharmaceutical prices up 11.7%

Pharmaceutical prices have risen by an average 11.7 per cent following the price revision effected under the 1987 Drug Prices Control Order, according to a sample survey conducted by the Organisation of Pharmaceutical Producers of India (OPPI).

The survey covered 23 member-companies of OPPI which together accounted for about 40 per cent of the drug sales through the trade and included price changes in both controlled and decontrolled drugs.

According to the survey, as a result of the price changes, including the changes in Central excise duty made in the last Budget, the combined sales value of the 23 companies increased from the pre-DPCO 1987 level of Rs. 1,071 crores to Rs. 1,196 crores, an increase of Rs. 125 crores or 11.7 per cent.

Of this duty, excise duty accounted for Rs. 28 crores, retailers' margin by Rs. 50 crores, wholesalers margin by Rs. 7 crores and the balance of Rs. 40 crores represented the manufacturers' margin. Percentagewise Central excise duty increased by 32 per cent to Rs. 114 crores from Rs. 86 crores, wholesalers' margin by 11 per cent to Rs. 72 crores from Rs. 65 crores, and manufacturers' margin by 5.2 per cent to Rs. 823 crores from Rs. 783 crores.

The survey showed that the higher price paid by the consumer benefited the retailer most, followed by the Government, wholesalers and the manufacturers, in that order.

At a press briefing in Bombay recently, OPPI spokesman said the survey was undertaken because there was no reliable data on the impact of DPCO. The conclusions are based on the preliminary data collected.

The gain of 5.2 per cent to the manufacturers is not only far below the inflation rate of 10 to 12 per cent, but is lower than the historical average annual price increase of six per cent obtained by the drug industry for more than a decade.

The average industry profitability was estimated at three per cent in 1987. With costs of inputs having gone up by more than 10 per cent and the price increase pegged at 5.2 per cent on the end product, the industry's profitability will further erode, OPPI contends.

While welcoming the reduction in the number of price-controlled drugs from 347 to 166, the ratios of price-controlled formulations to decontrolled is only marginally increased in favour of decontrolled by a meagre four per cent. The ORG estimate indicated the change in ratio from pre-DPCO to post-DPCO 87 as 77:23 to 73:27. The OPPI survey supports the ORG estimate.

The increase of just four per cent in the decontrolled category, OPPI contends, is far too insignificant to give stability to the industry, given the current rate of inflation and the avoidable time-lag in responding to inflation caused by the number of pending price revision applications and the understandable reluctance of the Government to allow any price increase.

The OPPI, Indian Drug Manufacturers Association (IDMA) and Pharmaceutical Producers and Allied Manufacturers and Dealers Association (PAMDAL) have jointly appealed to the Government that no decontrolled drugs and formulations should be brought under price control. On the contrary, to stimulate fresh investment, more bulk drugs and formulations shoud be decontrolled to achieve a ratio of 50:50 to start with.

SCIENTIFIC APPROACH TO PLANNING MOOTED

A new approach to the country's economic planning, with an emphasis on the integration of science end technology in its developmental programmes, was necessary to meet the problems of the next few decades, according to Dr. C. N. R. Rao, chairman of the Prime Minister's science advisory council.

Speaking at the Indian Institute of Management on the occasion of the felicitation accorded to Prof. V. K. R. V. Rao, national professor on his 80th birthday, the council chairman underlined that India did not have any time to waste as far as planning was concerned. The approach required a sense of urgency, he said.

Dr. C. N. R. Rao was not sure whether the methods of the past would give the required results, as science and technology had not been used in the manner it should have been. "For planning to become more effective, a considerable change is needed in the science and technology as used in the planning process," he said.

The council chairman said if India was to sustain her industrial growth "we must make use of the tools of science and technology to improve the quality of her products. Otherwise, industrial growth would only be temporary," he warned.

He emphasised that India must set very high goals and aim to become an economic power even as she tried to meet the needs of her citizens. A boom in exports from the country could be one way of achieving this, he said. Here again the tools of science and technology were essential, Dr. C. N. R. Rao pointed out.

MONTEDISON PLANT SHUT AFTER TANK BLAST

Italian environment minister Mr. Giorgio Ruffolo ordered the closure of an Italian chemical plant where a tank exploded and caught fire on 17th July 1988 forcing hundreds of people to flee their homes. Ruffolo told a Rome news conference that, with cabinet approval, he had ordered the precautionary closure of the Farmoplant site in the coastal town of Massa in northern Italy.

People living near the plant, owned by the Montedison Chemical Company, fled the area after a tank containing about 50,000 litres of cyclohexanone, used to make insecticides, exploded and caught fire.

About 150 people sought medical attention after a cloud of acrid smoke swept over neighbouring towns.

Fifteen were kept in hospital for observation after complaining of head-

MMTC to set up production units

The Minerals & Metals Trading Corporation (MMTC), primarily a trading company, will soon enter the manufacturing sector. The Corporation has now embarked on a major plan to set up its own production units using its surplus funds.

According to information available in New Delhi, these units will be 100 per cent export-oriented. Armed with trading links in over 65 countries, the Corporation could give its units a competitive edge in their foreign trade operations.

The Commerce Minister, Mr. Dinesh Singh, during his visit to the MMTC office recently, had proposed to set up production units so that the Corporation could diversify into manufacturing with the help of "additional funds"

At present, MMTC extends its "additional funds" as loans to its subsidiaries and Steel Authority of India Ltd. (SAIL). It also provides credit facilities to various buyers of imported raw materials and also to a few countries like GDR and Romania.

The total loans extended by MMTC during 1986-87 amounted to Rs. 221.92 crores which included Rs. 55 crores to SAIL on which it earned an interest of Rs. 9.5 crores. The loans to subsidiaries were Rs. 7.2 crores which were Rs. 2.2 crores higher than the previous year.

The outstanding bill receivables, from the importers had also been rising. They were Rs. 76 crores at the end of 1986-87 against Rs. 41.4 crores in the previous year.

The inventories of the Corporation has also increased to approximately Rs. 180 crores this year against Rs. 165 crores last year. The total current assets comprising inventories, sundry debtors, loans and advances and cash and bank balance were put at Rs. 523 crores last year.

"All the available surplus from the Corporation would now be diverted for setting up these production units, the detailed plan for which will be worked out soon", according to a highly-placed source.

He said, "It will be a major breakthrough" for the Corporation which is always endeavouring to equip itself to play a greater role.

"The units once set up would go a long way in helping MMTC diversify its product ranges, expand trade portfolios and widen its world market".

This year the Corporation has achieved a turnover of around Rs. 2,860 crores — just Rs. 82 crores higher than that of the last year. However, it is an encouraging trend as last year the turnover had fallen by Rs. 218 crores to Rs. 2,782 crores from the 1985-86 turnover of Rs. 3,000 crores.

The source said "with this breakthrough the Corporation would be able to increase its exports. This year, the exports are estimated to be around Rs. 690 crores. Of this, Rs. 334 crores were canalised and Rs. 356 crores non-canalised exports".

In 1986-87, MMTC exports had increased to Rs. 711.70 crores from Rs. 622.62 crores in 1985-86. The non-canalised exports were of the order of Rs. 319.01 crores.

1988 ENVIRONMENTAL CONTAMINATION CONFERENCE

The 3rd International Conference on Environmental contamination is to be held in Venice, Italy, from 26-29 September 1988.

This conference, the third in a biennial series, will present the latest technological developments and research results relating to environmental contamination of the air, soil and water.

Over 180 papers from 31 countries will be presented within the areas of contaminant movement in the environment — involving the interaction between air and soil pollution, ground water contamination and the drinking water supply, with discussion of the long term pollution and evolution effects. Micropollutants of concern, biodegradability and decontamination of water and land, water disposal at sea, toxic wastes and analytical methodology are among the other areas of discussion.

The event, sponsored by the United Nations Environment Programme (IRPTC) and World Health Organization will attract a large, international delegation from various fields concerned with environmental technology.

To obtain a copy of the Programme and Invitation to Register, the following may be contacted.

Environmental Contamination Secretariat CEP Consultants Ltd 26-28 Albany Street, EDINBURGH EH1 3QH UK.

Duty on plastics inputs to be revised soon

The Union Finance Ministry is likely to announce shortly a revised structure of customs duty on plastic raw material.

According to industry sources, this would give effect to the long-standing demands of the industry to rationalise the customs duty on polymers in view of the sky rocketing prices in the international markets.

The reductions effected at the time of the last Budget had failed to have the desired result because even with the new duty rates, the landed cost of imported raw material like polypropylene was almost Rs. 7,000 more than the indigenous one, the sources added.

It is pointed out that by bringing about reductions in customs duty on polymers, the Government would in fact be giving shape to the recommendations of the Kapoor Committee report on perspective planning for the petrochemical industry.

This report had advocated parity in prices between the imported and the indigenous raw materials which it felt was essential not only to stabilise the prices but also to check the tendency of the domestic manufacturers to indiscriminately hike their own prices at time of scarcity.

At present the customs duty on plastic resins was Rs. 2,000 per tonne basic plus 88.5 per cent on low density polyethylene (LDPE), while on high density polyethylene (HDPE) it was Rs. 1,000 per tonne basic plus a total of 88.5 per cent.

On polypropylene (PP) and copolymers, the duty amounted to a total of 95 per cent while on PVC it amounted to Rs. 4,000 per tonne basic plus a total of 60 per cent.

PVC, POLYSTYRENE PRICES UP

Five companies have jacked up the prices of two plastic raw materials, poly vinyl chloride (PVC) and polystyrene (PS).

National Organic Chemicals Ltd. (NOCIL) has increased its PVC price by Rs. 2250 per tonne. Polychem and Hindustan Polymers have hiked the price of PS by around Rs. 3000 a tonne.

Two other PVC manufacturers — Dhrangadhra Chemical Works Ltd. and Shri Ram Vinyl & Chemicals — had already jacked up their prices in anticipation of the rise in international prices. A third manufacturer, Chemicals & Plastics India Ltd., has now raised its price by Rs. 1,500.

The prices have been lifted in such a way that it is a little lower than the landed cost of imported material. This has been done intentionally so that consuming units should go in for indigenous material rather than go thorugh the hassle of imports for a negligent price advantage, consuming units allege. The manufacturers, as usual, attribute the price increase to rise in cost of production.

What about low density polyethylene (LDPE) and high density polyethylene (HDPE)? A hike in the price of these two commodity plastics will not take long, industry sources feel. In the case of LDPE, the decision is being delayed by top level changes in the management of Indian Petrochemicals Corporation Ltd. (IPCL). Polyolefins India Ltd. (PIL) is said to be restrained from hiking HDPE price by rumours of massive imports being planned by Reliance.

PVC PRICE HIKE DECRIED

The industry assailed the price hike of PVC and polystyrene recently announced by NOCIL, Polychem and Hindustan Polymers.

The President of the All-India Fedaration of Plastic Industries, Mr. M. R. Gupta, in a press release said that the increase in prices would hit the industry severely and ruin the small-scale processing units.

Mr. Gupta alleged that the price have been jacked up intentionally after the return of the chiefs of three local producers from their sponsored trip abroad gathering information about the soaring international prices and the scarcity of polymers in the global market.

He said the three manufacturers were included in the high power delegation to assist the Government in securing supply commitments from the foreign suppliers but contrary to this they have exploited the situation to their advantage.

Mr. Gupta urged the Government to restrain the local producers and direct the companies to withdraw the price

MOVE TO CURB IMPORTS:

PTFE consumers in a dilemma

Is the government's reported move to ban imports of Polytetrafluoroethylene (PTFE), a raw material for engineering plastics, another case of over-protection for a monopoly public sector company or is the user industry just crying wolf to promote the interests of foreign suppliers?

While the government has already hiked the import duty to a whopping 224 per cent and is reportedly planning to invoke the provisions of anti-dumping law to put PTFE imports on restricted list (Appendix 3) the processors have built up a case to prove that the bad quality, irregular supply schedule and high prices of PTFE resins supplied by the sole domestic manufacturer, the Hindustan Fluorocarbons Ltd. (HFL) a subsidiary of Hindustan Organic Chemicals Ltd., would retard the growth of the important engineering plastic industry.

Plastic processors, mostly small-scale units, feel there is no case of dumping as the government was making it out to be. Against a worldwide demand for 40,000 tonnes last year, India's requirements were only 200 tonnes, they say.

Furthermore, in the last three years, none of the major foreign manufacturers has reduced the prices of supplies to India. In fact, there has been an upward trend. Average prices of various grades quoted by Daikin of Japan have risen from $8.60 per kg in 1986 to $8.75 per kg in 1988. Similarly, ICI of the UK hiked its prices from £ 6.00 per kg in 1986 to £ 7.00 per kg this year. Du Pont of the US increased its prices by 35 cents within a year to $9.10 per kg in 1988.

With the recent hike in import duty, the landed cost of various imported grades range between Rs. 415 and Rs. 510. Against this, the prices of HFL manufactured resins are Rs. 355-470. This disproves the government claim that foreign suppliers were manoeuvring to maintain the prices of resins at 10 per cent less than domestic prices, the processors say.

HFL supplies only 11 grades of PTFE resins against 50-60 grades available in the international market. On an average each processor in the country uses over 20 grades, whose needs cannot obviously be met by HFL, they say.

By putting PTFE on the restricted list, the government will deprive the user industry of grades required for products used by industries such as aviation, chemicals, electronics and engineering.

The processors also quote instances of bad quality resins supplied by HFL. When samples of glass-filled PTFE were sent to two processors, they reported receiving two different colours, white and grey. In emulsion grades, processors reported to HFL that the stability of emulsion gets disturbed. HFL has acknowledged these deficiencies, but has not yet done anything to improve quality, the processors complain.

The processors attribute the reasons for bad quality and high prices of HFL manufactured PTFE resins to its collaboration. HFL's collaborator, Ato Chem AG of France, was one of the smallest manufacturer in the world and according to the processors was never known for its quality.

The user industry further says that Ato Chem which had acquired Ugine Kuhleman AG, another French company, wanted to close down the latter's PTFE manufacturing facility for not being viable. When HFL approached it for the technology, Ato Chem more than willingly parted with this facility, though it could not provide any back-up technology.

This is how HFL was saddled with a Rs. 40-crore, 500-tonne capacity plant, which does not have the capability to manufacture most of the grades required, particularly those used for high technology areas such as aviation, space, nuclear and defence programmes. According to industry sources, for a PTFE plant to be viable, it should have a minimum capacity of 2,500 tonnes.

The industry also fears that when PTFE imports are put in appendix 3, HFL will not only withdraw the 20 per cent discount it is giving on sale price, but also hike the prices as it likes, to make the plant viable. It has been done in the past, the processors say. For example, IPCL withdrew concessions on sale price as soon as LDPE and HDPE imports were put on the restricted list and, subsequently, raised the prices further.

Similarly, in the case of PVC, manufacturers like IPCL, NOCIL, Chemplast, Shri Ram, DCM and ILAC raised the prices after Appendix 3 came into effect. Now the situation is that the government has sent a team around the world hunting for PVC.

The industry, therefore, suggests that instead of banning PTFE imports, the government should put import of finished goods on the restricted list. This, according to the processors, would not only help in the growth of the processing industry but also boost the PTFE market and help HFL achieve its installed capacity.

The plant is working at only 30 per cent capacity now. The industry has further suggested that a committee be set up comprising representatives of the user industry, government and HFL to go into the whole ambit of PTFE import policy.

METAL BOX PLASTICS UNIT REOPENS

Metal Box India Ltd's paper and plastics unit at Mahul near Bombay resumed operations after being closed for six months.

Though the company has reopened the paper and plastics unit relying totally on the assurance of support from its customers and supplier, it is still pursuing with its lead bank, Grindlays Bank, the aspect of obtaining working capital funds for the effective functioning of the Mahul unit and for reopening the other two units at Worli and Deonar in Bombay.

Speaking to newsmen, its Managing Director, Mr. V. Krishna, said the decision to reopen the unit, even before the bank's revival package is through, has been taken to demonstrate the management's sincerity to its workmen. In fact, he said, the workmen's union affiliated to INTUC in their zeal for reviving the unit had signed a settlement with a 20 per cent cut in their wages and three-year dearness allowance freeze.

The company had sought from the lead bank a cash credit facility of Rs. 4.5 crores. Following the hearing of the Board for Industrial and Financial Restructuring (BIFR) in May last, the lead bank which had almost consented to provide funds changed its stand.

The lead bank took the stand that no working capital funds could be made available until the aspect of promoters' contribution was resolved, while the company had conveyed to the bank that promoters' contribution was relatable to the project cost and not for the working capital. The lead bank had asked for 20 per cent of Rs. 4.50 crores, the working capital sought by the company, from the promoters.

Meanwhile, BIFR in its hearing, apart from deciding to revive the Metal Box units, had asked the Industrial Credit and Investment Corporation of India (ICICI) to conduct a viability study on it. ICICI was to submit its study within 90 days.

According to well-informed sources at the Mahul unit, though the company, to end the impasse, persuaded the promoter Metal Box PLC to pledge their 33 per cent shares as security and the Kahitans, with their 7 per cent holdings, agreed to contribute Rs. 40 lakhs as part of the bank's precondition to extend the cash credit facility of Rs. 4.5 crores.

Surprisingly, on June 25, according to the sources, the lead bank, even before ICICI could complete its study, asked the company for a separate study about the viability of western region units to be conducted by an outside consultant. This, in fact, has caused quite a consternation in the management circles of the company since till date they are groping in the dark as to which consultant should do the viability study.

In all, Metal Box has eight units in the country with a total strength of about 6,200 workers and it is planning to reduce it by at least 1,500 to make the units viable. Of the eight units, three are in Bombay, two in Calcutta, one each in Madras, Mangalore and Faridabad. Its revival plan, for all the units, called for a package of around Rs. 30 crores.

MANGALORE PETROCHEM COMPLEX :

Unit may be on stream by May '92

The project authorities of the three-million tonne refinery-cum-petrochemical complex at Mangalore are trying to ensure that it goes on stream not later than May 1992, since, according to sources at Mangalore, every month's delay could entail a loss of Rs. three crores due to the shortage of refined products.

A steering committee has therefore been set up to ensure that along with the preparation of the detailed project and its review at various stages, work also goes on simultaneously on developing the infrastructure for the project. The steering committee consists of top government of Karnataka officials (the chief secretary, the secretaries, industry and finance, and the chairman of the Karnataka Electricity Board and the Karnataka Power Corporation) and top officials of the joint venture company which has been promoted by the Hindustan Petroleum Corporation (HPC) and Indian Rayon to set up the refinery projects.

The HPC chairman is also on the steering committee in his capacity as chairman of the joint venture company which is registered in Karnataka and had its first board meeting on July 4.

As per the latest schedule, the detailed project report (the DPR) which is currently being prepared by the American consultancy company Lummus, in collaboration with Engineers India Ltd. — (EIL) should be submitted to the joint venture committee by January 1989. To ensure that this deadline is met, a high-powered committee will be leaving for the USA to discuss with the American consultant various issues like process design.

The DPR will be processed and submitted to the Projects Investment Board (PIB), government of India by February 1989. The PIB will review the DPR and make its recommendations to the concerned Cabinet committee which is expected to submit its final approval by April-May 1989.

Sources are confident of commissioning the integrated refinery-cum-petrochemical complex within three years of receiving the final approval, based on indigenous experience in undertaking such projects in Bombay and elsewhere. They, however stress the need for the downstream projects to be ready for commissioning at least six months before the commissioning of the refinery so as to ensure prompt utilisation of the three by-products of the petrochemical project, the most important one being ethylene which will be generated to the tune of 2,50,000 tonnes a year.

Sources stress the need for flexibility while planning the project so as to provide for future expansion. Based on the experience at Koyali and Mathura, they state that the Mangalore project will not remain at three million tonnes but could go up to 10 million tonnes within the next 20 years.

Sources therefore estimated that the project would require between 1,800 to 2,000 acres by way of land.

While the exact requirements would be known in four weeks time (after detailed discussions with the American consultants on all aspects, including the space required for downstream units) it had also been noted that the units should not be located too far away from the petrochemical project since the movement of by-products would have to be by pipeline.

The project authorities however noted that the site was not in a straight line but that the drop in the gradient of contiguous areas was so much that construction work would be difficult and would entail additional expenditure running into crores of rupees. It was noted that any assistance which the state government could give (either by way of free land or nominal rent or exemption of stamp-duty in the case of purchase) would help the project authorities reduce costs, in keeping with the PIB proviso that the July 1986 estimate of Rs. 1,050 crores could be modified to allow for cost escalation only till such time as the submission of the DPR. While the final figure could rise up to Rs. 1,500 crores after allowing for this cost escalation, the project authorities noted that apart from the enhanced construction costs, it was also planned to install the latest hydrocracker technology which would involve an outlay of another Rs. 200 crores.

The project authorities also hoped at the cess on water supply would be minimal. Sources noted that it had been proposed that the barrage be constructed by the government at a cost of Rs. 20 crores, with the expenditure on the construction of the 30-inch pipeline for bringing water to the project over a distance of 40 km being borne by the joint-venture company. The project authorities pointed out that the barrage had been envisaged as a multi-purpose project which would also supply water and power to other users in the state. Since KPC had estimated that it would take about three years to commission the barrage which had to be ready at least six months before the refinery project went on stream, it was suggested that work on the barrage be started immediately.

Vis-a-vis power, the project authorities estimated that between four mw to five mw would be required from June 1989, when construction work was expected to start. It was still being discussed whether this power could be supplied through the existing 33 kva line or whether a new line would have to be constructed for this purpose.

The project authorities however noted that the actual power requirement for running and operating the refinery-cum-petrochemical complex would be met through captive generation, which had been included in the project cost.

The power requirement was estimated at between 30 mw to 40 mw and it was proposed to generate this through three units of either 10 mw or 15 mw each.

While it was noted that excellent package units could be imported from countries like France and Japan, it was also pointed out that by the time the project came up even BHEL could be in a position to supply gas-turbines. The project authorities however made it clear that there was no commitment to meeting the power requirements of downstream projects.

Sources stated that it had been estimated that an investment of about between Rs. 600 crores to Rs. 800 crores could be required for setting up the downstream projects and that the project authorities expected the state government to make an investment of at least Rs. 50 crores in the downstream projects.

It was argued that if the downstream projects were undertaken as a joint sector project with the participation of the state government and a debt-equity ratio of 2:1, the commitment from the state would be to the tune of Rs. 56 crores, as per the norm that 26 per cent of the equity for a joint sector project would have to be provided by the state government, 25 per cent by the other joint sector promoters and the remaining 49 per cent through public subscription.

The project authorities were emphatic that there should be a clear financial commitment by the state government to investing in the downstream projects, since the all-India financial institutions (FIs) could not invest in joint sector projects. Further, relying on public subscription could pose problems.

It was pointed out that the same difficulty existed for the main refinery cum-petrochemical complex for which an investment of Rs. 1,050 crores had been mooted in July 1986. Here, the debt-equity ratio was 4:1 and out of the equity of Rs. 210 crores, 52 per cent (Rs. 108 crores) was to be provided by the promoters, with the balance going to the public. After allowing for the equity, the remaining Rs. 840 crores had to be raised.

While 30 per cent of the project cost (Rs. 315 crores) was the foreign-exchange component, the balance of Rs. 525 crores would have to be raised through rupee debentures from the Indian public (with up to 40 per cent through NRI investment).

The project authorities noted that not only the joint venture for the Mangalore project but also the one for the Karnal and other refinery projects would have to raise money through public subscription. It was pointed out that, in all, public investment of up to Rs. 2,000 crores could be required for setting up all these projects and that too within a span of eight to 12 months.

Hence, the Mangalore project authorities wanted a clear financial commitment from the state, in addition to concessions on infrastructural facilities like land and water.

They argued that the project would trigger off an industrial boom in the South Kanara district and generate employment. Further, the state could recover its investment through sales-tax and excise-tax once the products were launched in the market, they said.

Bleak fertilizer prospects ahead

The country will face an acute shortage of fertiliser by the turn of the century. The world fertiliser prices are also likely to firm up to an extent that would make imports difficult.

As per the Planning Commission's estimates, foodgrain production must increase to about 235 to 240 million tonnes by 2000 AD to feed the projected population of one billion. To facilitate this, fertiliser consumption will have to increase from the present nine million tonnes nutrients to 20 million tonnes nutrients. In other words, the nutrients production must increase by one million tonnes every year.

Industry sources point out that given the present trend of government's thinking and the consequent uncertainty about the future of fertiliser industry in the country, it is highly unlikely that the production would match the demand level.

In fact, if more plants do not come up on the H-B-J pipeline, the fertiliser production in the country may stagnate in the coming years.

The world market prices firmed up substantially during 1987 putting an end to the euphoria generated by the low levels of prices obtaining in the later part of 1986. The indications from some recently concluded meetings in the international front point to an upward trend in urea prices which is expected to reach a level of $180 a tonne FOB by the end of 1988.

The growing tightness is also reflected in the difficulties faced by all major buyers including China, Philippines and countries in South America in producing their needs. Industry sources point out that this is likely to continue in the near future as supplies from the Eastern blocks and Gulf countries will continue to be restricted in view of commitments already made to China and Latin American countries.

The sources say that in assessing the medium and long term prospects, the predominating presence of China in the years ahead is too important to be ignored. It has plans for accelerated foodgrains production based on increased fertiliser use. Its domestic production of fertiliser will be quite insufficient in relation to the growing demand and therefore it will have to heavily depend upon imports.

The World Bank/UNIDO/FAO projections of demand-suppiy gap by 1990-91 and beyond also point towards and increasingly tight availability situation accompanied by further escalation in the prices in the years ahead. This trend will get further aggravated should India take a policy decision to depend more on imports.

Industry sources say that as it is, the slippages in the commissioning of three of the new gas-based plants along the HBJ pipeline will have worsened the global demand-supply balance still further.

They say that attention has also to be paid to the significant policy shift in Soviet Union which will be increasing internal consumption of fertilisers in its overall drive to reduce dependence on imports of grains from the USA. This, they say, would inevitably reduce available surplus from the dominant exporters.

NO PERMISSION FOR RELIANCE TO IMPORT HDPE, PVC

The Centre clarified that it had not given permission to Reliance Industries to import high density polyethylene (HDPE) and poly vinyl chloride (PVC).

The Secretary to the Department of Chemicals and Petrochemicals, Mr. H. K. Khan, while reacting to a specific query in this context, said imports of HDPE and PVC could be effected only by actual users under the open general licence. No one else could use this facility.

The question was asked as there have been rumours that Reliance Industries would be allowed to import two lakh tonnes of HDPE and PVC. Even a senior executive of the company had claimed that such imports would be allowed.

a rapid wrap-up of what's new in operations, processes & products

Sucrose as a bulk industrial chemical

We have referred to this subject in this column. Sucrose continues to attract attention particularly due to cheaper C-sources like High Fructose Syrups. Schiiweck **et. al.** (from West Germany). Detergents based on sucrose and fatty acids were one of the first industrial products; transesterification of methyl esters of fatty acids with sucrose is a viable process developed byProcter & Gamble. It is now being considered as an edible fatty material which is **not** hydrolysed by **lipase** and lowers and concentration of cholesterol in plasma. A chlorod-erivative of sucrose, 600 times sweeter has also been developed.

Sucrose nitrosoureas may act as anticarcinogenics. Acaricides can also be made from sucrose via xanthates. Pesticides based on the reaction between phthalic anhydride and sucrose have also been developed. Crystalline fructose can be obtained from invert sugars via liquid chromatogrphy.

Conversion to hydroxymethyl furfural (HMF) is attracting attention. D-Lactic acid can be made economically and active pesticides like Mecoprop and Dichlorprop can be made at attractive prices.

In the recent past a fermentation process for gamma linolenic acid as a lipid has been developed. (*Chem. Ind.,* 1988, 4th April, p. 228).

Spray of Pesticides: "Electrodyn" sprayer

Expensive pesticides as EC's are sprayed with somewhat outdated designs of spray nozzles which not only results in the loss of the expensive pesticide but also poses health problems. Some estimates indicate that only 40% of the material reaches the target. ICI have introduced an electrodynamic spraying system which uses electrical forces to generate very small, highly charged droplets and propel them to the target crop. The manual variety is especially useful to small farmers. This design has been tested for a number of crops in Brazil (cotton, tobacco, etc.). (Smith, R., *Chem. Ind.,* 1988, 21 March, 196).

Dimethallyl phthalate (DMAP)

Mitsubishi Rayon (of Japan) have claimed that DMAP can be made by treating sodium salt of phthalic acid with methallyl chloride in the presence of Cu(I) at pH between 8 and 13. 95% yield of DMAP has been realised. (*Chem. Abstr.,* 1988, **108,** 166992).

Sulphur Recovery Process

Freeport-McMoron Resource Partners of USA have come out with an interesting claim that elemental S in ores can be recovered by leaching with hot aqueous solutions containing CaS and/or $Ca(HS)_2$. The S is stabilised as Ca-polysulphide. The loaded solution is contacted with H_2S to give $Ca(HS)_2$ for recycling and S. (U.S.P. 4,722,832 of Feb. '88, *Chem. Abstr.,* 1988, **108,** 153016).

Separation of 2,6-dichloro from dichlorotoluene isomer mixtures

Hodogaya Chem. Co. of Japan have claimed that 2,6 isomer is adsorbed from the mixture with ZSM-8, ZSM-11, ZSM-21, ZSM-35 molecular sieves. Very high purity of 2,6 isomer can be obtained. (EP 249,833, Dec. '87, *Chem. Abstr.,* 1988, **108,** 152548).

Semi-batch precipitation in Gas-Liquid reaction

Carbonation of a slurry of calcium/barium/strontium hydroxide solutions has considerable practical value. Often it is desired to have large particles of the insoluble product. Yagi **et. al.** have operated such gas-liquid reactors continuously with respect to gas and liquid but batchwise with respect to solids. Most particles formed flocs. (*Chem. Eng. Comm.,* 1988, **65,** 109).

Liquid-liquid extraction in a hollow-fibre device (HFD)

Cooney and co-workers have referred to the use of HFD in the extraction of dissolved organics like phenol from aqueous solutions into solvents like n-hexanol, n-octanol. Experiments have been carried

out in a 26 cm long by 4.5 cm dia. device containing 8900 hollow fibres with an i.d. of 195 microns and 30 microns wall. The phenol solution was pumped through the tube side and the solvent on the shell side. Individual mass transfer resistances due to the tube-side fluid, the wall, and the shell-side fluid have been determined. Depending on the nature of the system and the controlling resistance hydrophobic or hydrophilic fibre should be selected. HFD's are efficient. (*Chem. Eng. Comm.*, 1987, **61,** 159).

Separation of fatty acids from fats and oils: Use of membranes

Kao Corporation (of Japan) have claimed that a polysulfone membrane allows selective permeation of fatty acids from soyabean oil and an initial mixture containing 56% fatty acids gives a permeate containing 89% fatty acids. (J.P. 62,289,204, Dec. 1987, *Chem. Abstr.*, 1988, **108.** 152516).

Acylation of aromatics

It has been claimed that zeolites catalyse the reaction between, say, benzene/toluene and acids to give the acyl derivative. Thus toluene reacts with lauric acid with Ce NaY zeolite at 150°C to give 94% yield for p-lauroyl toluene. (Fr. Pat. 2,592,037, June 1987, *Chem. Abstr.*, 1988, **108,** 152523).

Chiche **et. al.** have published a research paper on this subject where benzene, toluene, xylene have been reacted with $CH_3(CH)_2)_n$ COOH with n = O-14 in the presence of Ni^{2+} cation-exchanged montmorillonites (H^+, Al^{3+}, Ce^{3+}etc.). Yields of ketones were found to be dependent upon the nature of the interlayer cation and on the acid chain length. With C_{16}-C_{20} acids almost exclusively *para* product is formed over zeolite but with clay catalyst about 10% *meta* product is formed. (*J. Molecular Catalysis*, 1987, **42,** 229).

Mycelial Fermetation: Improvement by agitator retrofilling

Buckland **et. al.** (of MSD, N.J., USA) have shown, on a pilot plant scale, that the replacement of standard radial flow Rushton turbines with larger-diameter axial flow Prochem hydrofil impeller significantly improved the oxygen transfer efficiency in viscous mycelial fermentations. (*Biotech. Bioeng.*, 1988, **31,** 737).

Two-liquid phase reactor for 11 α-Hydroxylation of Progesterone

Ceen **et. al.** have used aqueousand a natural oil two-phase reaction system to carry out the transformation under reference with free cells of *Aspergillus ochraceus*. High oil ratios are not productive because of poor mass transfer to the concentrated cells in the aqueous phase. (*Biotech. Bioeng.*, 1988, **31,** 743).

Plate Heat Exchangers (PHE)

The plate design has several advantages of being compact and having low hold-up and weight, besides flexibility and high heat transfer coefficients. Aggressive chemicals can be handled as Ti/SS/etc. can be used; gaskets of nitrile rubber, EPDM, Viton, etc. are used. PHE are well suited for highly viscous materials (Viscosity higher than 100 cp). (*Process Engg.*, Jan. 1988, p. 41).

2,2 Dialkoxyethanols (DAE): versatile bifunctional synthones

Stambouli **et. al.,** have shown that DAE, obtained by mono acetalization of glyoxal with a large excess of alcohol in the presence of a catalyst, can be selectively converted to a variety of useful products. Thus hydride or catalytic reductions lead to alcohols which can be further hydrolysed to 2-hydroxy aldehydes or oxidised to give finally α-keto-aldehydes. From the oximes, nitriles and amines can be obtained; even from the aldehyde amines can be obtained directly. The Cannizzaro reaction also works. (*Bull. Soc. Chim. Fr.*, 1988, No. 1, p. 95).

Chemical engineering approach to dynamic modelling of linear chromatography

J. Villermaux has given a very appealing account of how a "systems approach" can be so very useful and how over sophistication of mathematical models can be useless. An important concept is the transfer-time distribution, describing distributed exchange on sites of different activities.

The methods summarized are very powerful and time-saving. An important application of these methods is the study of transient diffusion in porous solids. (*J. Chromatography*, 1987, **406,** 11-26).

Crystallization and precipitation engineering

Villermaux and co-workers have proposed a simple and efficient method (the method of classes) for solving the population balance equation in crystallization in the most general case: unsteady state, size dependent growth rate, agglomeration or breakage of crystals. A computer simulation of a semi-batch crystallization, with agglomeration and size dependent growth rate, is given; example being of adipic acid. The model allows one to represent at any time the crystal size distribution on a histogram. (*Chem. Eng. Sci.*, 1988, **43,** 59).

Unifying concepts in non-linear unsteady processes

Tondeur and co-workers have shown how non-linear unsteady processes, as different as car traffic, adsorption, sedimentation, packed-bed heat transfer and hydraulic waves, can be analysed in a unified manner by using the concept of the "travelling wave". The fundamental aspects of "solitary" (and "multicomponent") waves are discussed, as well as their distinctive features, such as overall and local propagation velocities, shape modifications appearance of shocks and "coherent" asymptotic shape. It is interesting to note that qualitative rules result from the analysis of "operating lines" and "equilibrium lines" in the flux **vs.** conc. diagram, in a manner analogus to the famous McCabe-Thiele method. (*Chem. Eng. Process.*, 1987, **21,** 167-178; **22,** 91-105).

Electrochemicals: Epoxidation of hexene in liquid-liquid system

Alkire and Kohler have carried out mediated electrolytic synthesis of 1,2-epoxy-hexane from 1-hexene in an undivided parallel-plate reactor at 25°C. The electro-active Br_2/Br^- couple acted as the mediating species. Epoxide current efficiencies around 65% were realised. Mass transfer factors were important. This is a good model reaction system. (*J. Appl. Electrochem.*, 1988, **18, 405).**

Chlorination of toluene by two-phase electrolysis

Morita **et. al.,** have shown that chlorination of toluene can be done in a homogeneous system (with CH_3CN as a solvent and containing some Lewis acids) as well as a two-phase system. The ratio of *ortho* to *para chloro* product was around 2; in benzene based system it is possible to manipulate conditions to give only benzyl chloride. (*J. Appl. Electrochem.*, 1988, **18,** 491).

Perfluorochemicals in biotechnology

Mattiasson and Adlercreutz have shown that perfluorochemicals, which show markedly higher solubility for oxygen compared to that in water, can be very useful in such application in biotechnology where O_2 transport is a limiting factor. In some solvents like perfluorobutyl tetrahydrofuran the solubility is about 20 times that in water. Thus fermentation can be intensified with O_2 supplied through this route.

It is likely that some products can also get preferentially extracted into the organic phase and this may improve selectivity and recoverability. For medical applications, physiologically acceptable emulsifiers are necessary and droplet size should be less than 0.1 micron. *BioTech., 1987,* **5,** p. 250).

Microemulsions

M. Kahlweit has given a lucid account of this subject of scientific and practical value in a recent issue of *Science* (1988, Vol. 240, (29 April) p. 617-621). Water and oil are made completely miscible by adding a sufficient amount of an amphillic compound and such homogeneous "colloidal" emulsions are called microemulsions. There are many intriguing aspects. For instance, why does a particular amphiphille reach its highest efficienty only at a particular temperature. We should aim at synthesising detergents which work at ambient temperatures than at 60°C. Simple non-ionic amphiphiles can completely solubilise a large amount of water and oil.

Efficiency of particle capture in colloid filtration

Cintre **et. al.** have presented an experimental study of the efficiency of capture of calibrated latex particles in the range 0.08 to 2.0 microns in beds of mono-sized spheres in the range of 20 to 82 microns. This is a kind of hydrodynamic chromatography. Colloidal interactions based on van der Waals forces and double layer repulsion are important. The ionic strength of the solution can be manipulated to give proper separations. (*Filtration and Separation,* 1987, July/Aug., p. 259).

2,6-dihalo-4-cyano phenol esters (DHCP) as herbicides

ICI have claimed that 4-cyano-phenol can be halogenated by bubbling Cl_2 in an aqueous suspension of the phenolic material containing dissolved $CaBr_2$. Subsequently NaOH can be added and in a two-phase system, with toluene as the second phase, esterification with octanoyl chloride can be carried out to give the desired herbicide. (U.K. P. Appl., GB 2,187,737, Sep. 1987, *Chem. Abstr., 1988,* **108,** 204334).

Asymmetric Dihydroxylation (AD) of Olefins

The asymmetric epoxidation of allylic alcohols by Sharpless and co-workers heralded a new reaction scheme. Now the same group has come out with a very fascinating AD of olefins with 0.002 mole of osmium/alkaloid (dihydroquindine **p-** chlorobenzoate) catalyst per 100 moles substrate. Thus 1 mole of *trans* stilbene when reacted, in the presence of the above catalyst, and 1.2 moles of *N*-methyl-morpholine *N* oxide per mole of the olefin in acetone-water at 0 to 4°C, to give 89% of (R,R)-hydro benzoin with 78% e.e. (Recrystallisation of the above material gave 55% yield with greater than 99% e.e. This procedure holds high promise. (*J. Am. Chem. Soc.,* 1988, **110,** 1968).

Catalyst and network modeling in vegetable oil hydrogenation processes

Grau, Cassano and Baltanas have given a very useful state-of-the-art-review on vegetable oil hydrogenation -- a process which has been practised for almost a century. Hydrogen chemisorption seems to be independent of unsaturate chemisorption and the former chemisorption is an equilibrium reaction; saturated species do not chemisorb. A full network is given and the relationship between theory and practice has been brought out. (*Cat. Rev. Sci. Eng.,* 1988, **30,** No. 1, 1-48).

Noble metal catalyst recovery through a membrane

Ruhrchemie, who pioneered the Oxo reaction (Roelen reaction), have now come out with a water soluble Rh triphenyl-phosphine trisulfonate catalyst. They now claim that the catalyst can be recovered by a membrane process (ultrafiltration or reverse osmosis) using a cellulose acetate membrane; the Rh-containing retentate is sent back to the reactor. (Ger. Offen DE 3,630,587, 1988, *Cf. Chem. Abstr.,* 1988, **108,** 223834).

New methods of probing the structure of catalysts

Williams, Yashonath and Thomas have given a very useful account of some of the methods based in probing the structure and performance of heterogeneous catalysts. These methods include: X-ray diffraction, neutron diffraction and neutron inelastic scattering, high-resolution electron microscopy, electron diffraction, electron energy loss spectroscopy, and computational methods. These techniques help immensely in understanding the nature and behaviour of heterogeneous catalysts. Thus the authors have discussed the determination by X-ray diffraction of siting and occupancy of extra-framework cation Ni^{2+} in faujasite or by neutron diffraction of H^+ in La^{3+} - Y catalysts. (*Int. Rev. Phy. Chem.,* 1988, **7,** No. 1, 81-87).

Enhanced kinetic resolution and enzyme-like shape selectivity

Sharpless and co-workers continue to come out with innovative ideas based on their original work on asymmetric epoxidation of allylic alcohols. They have now shown that the titanium-tartarate epoxidation catalysts can achieve the levels of chiral recognition formerly associated only with enzymatic processes. The relative rates of epoxidation of some allylic alcohols mixtures have been found to be as high as 700. (*J. Am. Chem. Soc.,* 1988, **110,** 2978).

Stereoselective organic reactions : Catalysts for carbonyl addition reactions

D.A. Evans (*Science, 1988,* **240,** 22 April, p. 420-426) has given a fascinating account of stereoselective syntheses which were, less than a decade ago, considered impossible without enzymatic processes. The asymmetric epoxidation of allylic alcohols has been referred to earlier. Hydrogenation to give 90-99% enantio selection is possible in some cases. Details of enantio selective ketone reduction and aldehyde addition are given.

Natural food colours being developed

Indian scientists are developing technology for making natural food colours, forseeing a ban on synthetic colours prompted by consumers' concern over their toxicity.

Scientists at the Central Food and Technological Research Institute recently have taken the first step in this direction by making artificial colourants from pigment bearing plants.

The CFTRI has developed technology for producing colours in a dispersed dry powder form from safflower petals, blue grapes, turmeric, annato seeds, kokum fruits and beet root.

Process details for the manufacture of these colours have been standardised, says the CFTRI Deputy Director, Dr. D. Rajagopal Rao.

These natural colours find use in the preparation of products like syrups, jams, jellies, sauces, soft drinks and dairy products.

"Natural colours in general, however, have inherent limitations of tinctorial power, availability and cost", says Dr. Rao, who is the head of CFTRI's food chemistry division which is working on the colours.

"There is a change in trend in the use of colours in food and the day is not far off when natural colours will replace synthetic ones once and for all", he says.

World legislation on added colours is very restrictive and the list of permitted colours is fast shinking.

"There is now greater understanding of synthetic colours toxicological properties and concern for food safety", Dr. Rao says. Global public pressure to switch from artificial colourants to natural ones has forced the Indian Government also to contemplate a total ban on synthetic colours, the scientists say.

The prevention of Food Adulteration Act of 1954 permits in India the use of natural colourants derived from turmeric, annato, red-beet saffron, caramel, and chlorophyl concentrate.

It also allows the use of nature-identical' synthetic carotenoid like beta-carotin, beta-ago-eight-carotenol and canthaxanthin.

"Colours will continue to play an important role because of the aesthetic appeal they give to food.

Chemicals used recently as food colourants include riboflavin which is added also as a nutrient.

Colourants like carotenoids are found in most plant foods, milk, eggs sea-food and poultry. More than 300 carotenoid pigments have been identified by scientists and 100 of them have been synthesised.

The limitations in their use are "intrinsic instability" because of oxidation and poor solubility.

The carotenoids, beta-carotene and canthaxanthin encompass colours ranging from yellow to orange, a tomato red at higher concentrations or a strawberry colour at maximum permissible limits.

Besides, polymer dyes are also used as food colourants.

Coal-tar dyes are most commonly used for artificial colouring of foods but scientists have noted several problems in their application.

NEW METHOD TO EXTRACT DNA

Indian scientists have developed a new method for large-scale preparation of 'deoxyribonucleic acid' (DNA) from sheep liver. DNA is an important biochemical used in genetic engineering.

The method, developed by scientists at the Centre for Cellular and Molecular Biology, Hyderabad, makes use of simple equipment which is easily available in the country.

The quality of DNA compares very well with the best available abroad. It is cheaper than many of the imported ones, Dr. B. S. N. Murthy and Dr. M. W. Pandit, CCMB scientists, say in a paper published in the Indian Journal of Research and Industry.

The scientists say the quality of the product is equivalent or even superior in some cases when compared with the preparation available in the market.

The steps involved in the isolation procedure are mostly chemical and mechanical, according to the scientists. They say the cost of production of one gram of DNA works out to Rs. 450, which is certainly cheaper than the imported DNA.

The journal says one kilogram of a tissue from sheep liver yields about one gram of DNA, which is reasonable free from protein contamination. The product isolated by the scientists using the method is highly stable. It has been found stable for more than a year.

First iron fortified salt project commissioned

The State-owned Tamil Nadu Salt Corporation (TNSC) had posted new records in several areas of its operations during the year ending December 31, 1987 including sales and despatches, collections, productivity and quality upgradation. The year also marked a significant milestone in the successful commissioning of the World's first commercial Iron Fortified Salt (IFS) Project to tackle the endemic anaemia. Disclosing these at a news conference, Mr. D. Sridharan, Chairman and Managing Director of TNSC stressed that coming in the backdrop of the crisis of plenty characterizing the Salt Industry the Country over, it redounded to the credit of the Corporation. He also added that despite the several teething troubles the IFS Project had successfully been given trial runs twice and five tonnes of the product produced. The stage is thus set for the commercial launch of this iron enriched salt.

Mismatch between production and offtake:

Mr. Sridharan stressed that the performance of any Company and that too in a competitive group cannot be judged in isolation but only by the overall Industry scenario. The Salt Industry the Country over is passing through a grave crisis arising from a severe mismatch between production and offtake. In the last decade (1978-87) salt production had spurted from 66.9 lakh tonnes to over 101.2 lakh tonnes (+51.3%). Offtake of salt which was very close to the production (61.5 lakh tonnes) in 1978, had increased no doubt but only to 85 lakh tonnes. Exports, which had gone up to 4.87 lakh tonnes in 1983, had been on the decline and even in the year ending December 31. 1987 it had been only 4.33 lakh tonnes way below the target of 12 lakh tonnes fixed even for 1984-85 and 15 lakh tonnes for the terminal year of the Seventh Plan (1989-90). In fine, while the production of salt has increased by 22.5 lakh tonnes the stocks have increased by 41.5 lakh tonnes in the last four years (1984-87).

Severe repercussions:

Mr. Sridharan outlined the deleterious affects arising from the burgeoning stocks representing nearly nine months of production and characterized them as many in number, varied in character and great in intensity. Again, in the major salt producing State of Gujarat, accounting for over 65% of the Country's production, the unlicensed sector gets a price realization of only Rs. 25 per tonne ex-works. Mr. Sridharan stressed that unless urgent remedial action was taken and financial viability imparted, the harmful effects would leave a permanent mark on the salt economy.

Importance of Salt Industry:

Mr. Sridharan stressed that the worth and unparallelel importance of salt were often ignored in many quarters. In its pure state, as many as 62 industries are served by common salt. The versatility of this mineral is evident from the fact that it is perhraps the only item according to the Salt Institute of the US, with more than 14,000 uses in the world. Mr. Sridharan stressed that it was no wonder that salt was reckoned as one of the five important raw materials. The production and consumption of salt, along with Sulphuric acid and steel, is taken as an index of a nations prosperity.

Indian import of salt:

Mr. Sridharan added that public memory being short it was forgotten that India had been importing salt till 1952. The import was also sizable to the extent of 3 lakh tonnes/annum representing 14% of our then requirement and met primarily from United Kingdom, Aden and other West-Asian Salt Works.

Primacy of emphasis needed:

In the opinion of Mr. Sridharan, Salt Industry deserves primacy of importance for a number of reasons. For one thing it used sea brine and solar energy for its raw material and conversion into common salt and these are available in inexhaustible plenty. For another, most of the salt producing units are in the most backward areas and production activity itself is undertaken in summer when the normal agricultural activities are at their lowest ebb. Another reason is that there are as many as 10,000 units in the small scale sector operating area below four hectares and producing nearly 30 lakh tonnes/year. It should be widely noted and deeply appre-

ciated that many parts of the Country are endowed with favourable factors for salt manufacture including low rainfall (50-60 cm), limited duration of even the low rainfall (July-October), high temperature (upto 40°C), low relative humidity (40-70%) and high wind velocity (around 20 km/hour), stressed Mr. Sridharan adding that a long coastline of over 7,500 km endowed with so many favourable factors should set its sights high both in the domestic and in the international markets.

National Salt Buffer Imperative :

Mr. Sridharan reiterated the case for a Salt Buffer mooted by him at many a Forum. The problem has been engaging the attention of the Government at various levels including the highest body of the Central Advisory Board (CAB) for Salt Industry and its Committee has given a package of programmes including several steps by the Railways to stream-line its procedures, voluntary cut of 10% in production over the previous year by Category I Salt Works whose holdings are more than 100 acres, temporarily suspending the fresh licence for salt manufacture. Although TNSC severely pruned its production in 1987 with a view to bring down the burgeoning stocks the overall position has remained as gloomy as before. The National Salt Buffer (NSB), according to Mr. Sridharan, was based on the rationale that of the production of 99 lakh tonnes the Industry's commitment to shoulder carryover stocks should be for a level of 50 lakh tonnes representing six months of production. As against this, the 1987 year end stocks came to 79 lakh tonnes or excess stocks of 29 lakh tonnes. In the first phase NSB should give relief atleast to the tune of 50% or about 15 lakh tonnes. The modalities visualized by Mr. Sridharan envisaged the Government owning the stocks but the physical holding would continue to be vested with the Salt Works themselves. Alternatively, relief should be given to the Salt Works by way of holding charges with Government enforcing its right to call for a specified proportion of the stocks in case of need, say, upto 25% of the stocks so financed by the Government.

Highlights of 1987 performance :

Mr. Sridharan expressed considerable satisfaction that, in the year of grave crisis faced by the Industry, TNSC made significant progress in a number of areas comprising a spetrum of issues including sales and despatches, collection, quality upgradation etc.

Despatches for the year 1987 at 33,774 tonnes represented an increase of 47% over the corresponding figure of 22,998 tonnes during the previous year. A still higher achievement could have been possible but for the 'stop supply orders' issued by several major consumers in the four Southern States. Even Andhra Pradesh had experienced power cut of a high level leading to the stoppage of lifting by a prominent Chlor-alkali industrial consumer located in West Godavari District Similarly the stoppage of supplies enforced by customers in Tuticorin, Udyogamandal in Kerala etc had to be reckoned with but for which sales would have been much higher than the 47% increase registered in 1987.

Quality upgradation :

Mr. Sridharan stressed the imperative need for the Salt Industry going in for improved quality especially taking note of the emerging new technology in Chlor-alkali industries. The caustic soda manufacturers were switching over from the use of the old mercury cells to using titanium anodes or membrane process both for energy saving and avoidance of pollution. The new technology would require even industrial grade salt I. It is not widely recognised that the quality specs of the various grades of industrial salt vary widely. For example, it is not merely that the Sodium Chloride content is one percentage point higher in grade I (99.5%) as compared to grade II (98.5%) but the standards for various impurities are very much more stringent. For example, the Magnesium level (0.01%) permitted in Grade I is ten times more stringent than that in Grade II (0.1%). Again in respect of Calcium, the purity standards in Grade I are nearly seven times that in Grade II.

Positive Government's response :

Mr. Sridharan referred to the positive response from the State Government which had already conveyed its agreement in principle, to

TNSC going in for production of 78,000 tonnes/ annum of improved quality with an investment of Rs. 25 lakhs.

World's First Iron Fortified Salt Project :

The year witnessed, according to Mr. Sridharan, the successful completion and trial run (twice) of the World's first Iron Fortified Salt (IFS) implemented with active collaboration and assistance of UNICEF and Government of India's Food and Nutrition Board (FNB). The Project, with a capital cost of Rs. 25 lakhs, is funded by UNICEF for the Plant and Machinery (Rs. 15 lakhs) and FNB by way of loans for Rs. 9 lakhs towards building, electrical works, with TNSC providing land and complete operations.

Superiority of IFS :

Mr. Sridharan claimed that even among genre of special salts IFS was **sui generis.** This pride of place even among special salts was because whereas Iodized salt contains only one chemical (Pottasium iodate), IFS contains three (Ferrous Sulphate, Sodium Dihydrogen Orthophosphate, Sodium Acid Sulphate). The value of special chemicals in IFS would be seventeen times that in Iodized salt. One tonne of IFS has an ingredient of chemicals of Rs. 127.50 as against a mere Rs. 7.20 in a tonne of Iodized salt. Again, whereas iodized salt would cater to goitre and other iodine deficiency disorders, localized in some parts of the Country, IFS would cater to all cross sections of the Indian population spread over the length and breadth of the Country.

Pricing, production promotion and publicity :

Even though TNSC would be justified in pricing its IFS product at a much higher level than that of iodized salt (sold at Rs. 2/kg. in retail) yet, taking into account the pioneering nature, the Management has deliberately sought to make the benefits available to the public at a quick pace and priced it consciously at a level even lower than that of iodized salt. This should help achieve a breakthrough and pave the way for higher levels of capacity utilization. The retail price of IFS would be Rs. 1.75/kg and it would be the endeavour of the Management to maintain this price firm for atleast six months.

PETROCHEMICAL DEVELOPMENT AUTHORITY SOON

The Union government will soon set up a petrochemicals promotion and development authority (PPDA) in view of the growing importance of petrochemicals to the country's economy and the need for judicious and steady promotion of their usage.

Final touches to the proposal, which was part of the recommendations of the committee for perspective planning of the petrochemical industry, were given at an inter-ministerial meeting at New Delhi on July 14.

Official sources said the PPDA would be constituted by October this year. It will function, as an autonomous body to promote, among other things, uses and applications of petrochemicals and sharing of information and expertise.

The PPDA will be funded through a cess levied on private and public sector manufacturing units, the sources said.

The functions of the PPDA would involve rendering financial and other assistance for the development of the industry in India. These will include identifying and supporting the development of basic petrochemicals and their end products in areas relevant to the present and future needs of the company, the sources said.

The PPDA will also initiate vavious studies, promote quality consciousness among processors and consumers, develop need-based curriculum on petrochemicals for adoption in polytechnics and universities and identify training and manpower needs.

The PPDA is expected to have three sub-groups on polymers, fibres and chemicals, the sources said.

India accounts for 3 PC of scientific litrature

India accounts for three per cent of the world scientific literature output and about half of the entire third World's.

But none of the Indian science journals enjoy a great 'impact factor' and most have a poor international citation record, says a study.

The work reported in these journals is mostly of peripheral interest and often imitative of extending known trends rather than path-breaking or of current relevance to frontline research.

These journals are poorly circulated and many of them appear several months behind schedule and some are not covered by the appropriate international indexing and abstracting services, according to the study published in the Journal of Scientific and Industrial Research.

One reason for the bulk of the work reported in Indian journals being of low current relevance is the average Indian scientist's lack of access to new information, says the study by Subbiah Arunachalam of CSIR's publication and information directorate at N. Delhi.

Another reason is the low standard of 'referreeing' and the inadequacies in the peer review process which permit publication of papers of low quality.

The study. however, says using Indian journals as a handle to describe Indian research has pitfalls for Indian researchers publish a good proportion of their work in several non-Indian journals, even if many of them are low-impact journals. "What is more, often the better quality papers get published abroad", says Mr. Arunachalam.

Not only does the United States publish the largest percentage of papers but also its papers are quoted marginally more often than would be expected on the basis of the 'impact factors' of journals in which these papers have appeared.

Britain, West Germany, Canada and a few other countries also have better citation rates than the ones indicated by the impact factors of journals where their papers have appeared.

In contrast, the study says, the fewer papers published from Indian addresses are quoted fewer times than would be expected from the impact factors of journals in which these papers have been published.

This is despite the fact that virtually the entire literature originating in India is in English and therefore does not suffer discrimination due to the language barrier.

The language barrier is a factor to be considered when dealing with the citation records of the Soviet Union, France and West Germany, the study says.

The journals are evaluated by their 'SCI' citation profiles — the number of times articles in the journals get cited in the international journal literature.

The SCI or 'science citation index' published by the Institute for Scientific Information, Philadelphia, covers only a small fraction of Indian journals.

The citation record of Indian journals will be even poorer if SCI were to cover a larger number of Indian journals than it does now for the institute covers the better-cited journals.

Although SCI's choice of journals for coverage cannot be generally faulted, there is a feeling in developing countries, particularly in Latin America, that SCI under-represents the scientific output of the Third World.

If one were to go by the contents of the journals, science in India appears to be divided into two distinct levels, one almost cut off from the other, according to the study.

At one level, where much of the good work is done, the practitioners are more at home with their counterparts elsewhere with whom they share the same invisible colleges.

Naturally, the study says, they continue to publish in overseas journals, mostly in the United States and Britain. Rarely do they submit papers to national or local journals. Even if they do, they would rarely submit what they consider to be the better ones.

At the other level, the study notes that many people tackle problems of not much current relevance, scientific significance or originality.

They make occasional attempts to publish their work in high impact international journals but often get their papers published in Indian journals or in foreign journals of low significance.

Those national journals which are better off than the rest attract papers from that class of scientists who usually publish in international journals.

Sun bursting with activity

The sun's activity is increasing at very fast rate and this burst of so- r activity can reach a peak by the id of next year.

Researchers at the US National ceanic and Atmospheric Administ- tion (NOAA) say the sun's activity increasing at the fastest rate since bservations began in 1840.

When the sun is more active, it scharges more cosmic rays, some of hich reach earth. Scientists fear hat the peak of solar activity could ose a serious radiation hazard to stronauts and even to passengers in ircraft at high altitudes.

The activity of the sun also disrupts adio communications, power lines nd telephone cables and an increas- d solar wind — the stream of charg- d particles from the sun — could isturb the paths of some of the 200 r so artificial satellites in orbit ar- und the earth, causing them to re- nter the atmosphere prematurely. One consolation is that it could close he hole in the ozone layer tempo- arily.

Solar activity carries over a regu- ar cycle of about eleven years. Many eatures of the sun change over the ycle and at its peak of activity, it s very 'stormy', with magnetic dis- urbances, large flares and other out- ursts.

The most visible manifestations of f this activity are a number of dark spots on the surface of the sun. Be- ause of this, the changing activity s called the sunspot cycle and the evel of activity is measured in terms f the sunspot number.

Accurate records of sunspot acti- ity dateback to the 1840s. Earlier ecords are sketchy, but suggest that the sun was less active and less spotty during the very cold decades of the ate 17th century that are known as the "little ice age".

The study by NOAA, headed by Dr. Gary Heckman, uses data from the sunspot index data centre, part f the Roy l Observatory of Belgium.

The present solar cycle began in September 1986 with solar activity at a minimum. A sunspot number of 150 has usually been considered to show a high peak of activity. Figures for 1988 show that the sunspot num- ber had risen to 75.8 in March and 88 in April, though it slipped back to 59.7 in May. When smoothed to eliminate erratic fluctuations, they will yield a figure of 86 for May.

No previous cycle since 1840 has risen so rapidly at this stage of its development. The sunspot index data centre has issued a forecast that the next peak will be at a sunspot number of about 170, perhaps even 200, in September next year.

In an independent study, Dr. Jim Shirley, a California-based scientist, had predicted just such a peak of activity.

Dr. Shipley, who has been study- ing changes in solar activity, has tried to explain the changes in solar activity.

The sun is not the true centre of the solar system, which is deter- mined by the positions and masses of all the planets relative to the sun, Dr. Shirley says. It makes more sense to regard the centre of mass as fixed and to describe the orbits of the planets around this centre.

On this basis, the sun follows a looping orbit around the centre of mass, which is sometimes near the heart of the sun and sometimes outside its surface.

Records show that there is a clear correspondence between the rate of change of the sun's angular mo- mentum and the annual mean of sunspot numbers.

Dr. Shipley noticed that the sun is now beginning a particularly un- usual loop about the centre of mass of the solar system. Between 1988 and 2000, it will be travelling "back- wards" compared with its average direction of motion over the past 13 centuries.

In this retrograde loop, the sun stays on one side of the centre of mass all the time, instead of actual- ly travelling around it. It travels the "wrong way" relative to the centre of mass during its closest ap- proach to the centre from 1989 to 1991.

Most calculations suggest that when the sun is more active, one effect of the increased flow of par- ticles in the solar wind is to en- courage reactions high in the atmos- phere of the earth that promote the production of more ozone in the stratosphere.

This effect ought to be most pro- nounced in the polar regions, where charged particles from the solar wind are funnelled down by the earth's magnetic field. Some theori- sts attribute the growth of the An- tarctic ozone hole between 1979 and 1988 partly due to a decline in solar activity.

'Anuradha' helps solve cosmic ray mystery

The Indian space experiment, "Anuradha", which was carried out on board an American space shuttle, has thrown fresh light on mysterious cosmic rays.

The latest results belie the conventional theories on the propagation of cosmic rays which constantly bombard us.

Prof. S. Biswas of the Tata Institute of Fundamental Research, principal investigator of the project, briefed newsmen on an analysis of the data which will be presented at an international symposium on cosmic ray studies in space, in Helsinki in the third week of July.

The cosmic ray experiment. "Anuradha" was carried out in spacelab-3 aboard the space shuttle "Challengar" between April 29 to May 6, 1985.

The instrument was designed and fabricated by scientists at TIFR, Bhabha Atomic Research Centre at Bombay, Physical Research Laboratory, Ahmedabad and Indian Space Research Organisation, Bangalore.

Abnormal Ratios

A significant discovery made by the Indian Scientists in this study was the abnormally high presence of chromium, manganese and iron in low energy cosmic rays compared to the presence of carbon and oxygen.

According to conventional theories, the ratio of iron to its sister elements like chromium should be the same as that to carbon and oxygen. This departure from the established theories called for new models of the path traversed by cosmic rays, according to Prof Biswas.

That iron particles may have a different history of origin. Evolution and propagation while travelling from a nearby galaxy over millions of years shows for the first time that propagation of the cosmic rays is not a simple process but involves several steps.

What made the production of iron higher than other elements will now be investigated by physicists.

The Indian experiment has also found in another type of rays called "anomalous cosmic rays" differing states of oxygen, nitrogen, neon and magnesium ions.

More than the data and their implications "Anuradha" firmly established that the method adopted by Indian Scientists for studying low energy cosmic rays was successful and ideal.

Scientists in West Germany are currently planning an experiment based on the design of Anuradha. Russians have also designed an identical instrument.

Unlike the satellite experiments which were carried out deep in space, for near-earth studies, the Indian experiment has now provided a new method for the scientific community. Ionisation states of cosmic rays can be studied only in near-earth space, about 300 km above the earth's atmosphere.

GLASS MELTING WITH LESS HAZARDOUS EMISSIONS

Developmental work has just begun in Germany on a new glass melting procedure that will produce significantly lower emissions of hazardous nitrous oxides and sulphur-dioxide than caused by the commonly used methods.

Glass tanks used currently are so constructed that hazardous gases can be disposed of only through systems added on to them. In contrast, the plans for the new method call for realising the principle of 'recuperative heat' that is a tank basin that makes the heating-up of the glass batches and broken glass an integral part of the melting process.

Preheating the broken glass constitutes some sort of a filter, so that dust emission is lowered to below 50 milligrams per standard cubic metre of fumes.

HAZIRA COMPLEX DEDICATED

The Rs. 600-crore ONGC gas processing complex, the first of its kind in India and eleventh in Asia, was dedicated to the nation by Union minister of state for petroleum and natural gas, Brahm Dutt, at Hazira.

Speaking on the occasion, Mr. Dutt said such projects, besides contributing to the country's economic growth, also maintained ecological balance. It would provide clean and

SPIC open workshop facility in new Bombay

Mr. S. K. Manglik, Member (Technical), Oil and Natural Gas Commission, inaugurated the SPIC-SMO workshop facility at Vashi, New Bombay on July 11.

SPIC-SMO is the fast-growing project consultancy services division of Southern Petrochemical Industries Corporation Limited (SPIC).

SPIC-SMO offers specialised and comprehensive technical services to a wide range of industries in the fertiliser, chemical, petrochemical, oil and gas, power transmission and power engineering sectors.

Within a short span since its inception, SPIC-SMO has already executed several prestigious orders from various clients and its future growth appears assured.

With a view to meet the contemporary needs of the industry, particularly those of the process industries, in the western part of India, SPIC-SMO has put up the Rs. 2.8-crore workshop facility near Vashi in New Bombay. The modern workshop offers online and shutdown inspection and monitoring services utilising state-of-art equipment and process.

The workshop is designed to be versatile enough to undertake oven major repairs and overhauls with the help of modern machine tools viz heavy duty lathes, computerised numerical controlled (CNC) turning centre, dynamic balancing machine, programmable milling machine and horizontal boring machine, etc to meet the accuracy, speed and economy demanded by industries on any sophisticated maintenance and repair jobs.

Online condition monitoring of high-speed rotating machineries is a speciality of SPIC-SMO services.

Dedicating the SPIC-SMO workshop facility to Indian industries Mr. S. K. Manglik said that large sized process plants such as the gas cracker plant coming at Nagothone and other offshore installations along the other major process plants in the western region particularly in Maharashtra would necessarily involve high tech equipments and sophistication in technology.

This would call for similar type of maintenance which would guarantee high degree of reliability and performance of equipments after repairs.

Mr. Manglik stated that ONGC was keen to utilise infrastructures available in its locations and in developing indigenous capabilities. SMO was already associated with ONGC in Dew Point Depression unit and commissioning of LPG units at Hazira.

Presiding over the inaugural function Mr. B.K. Shah, Director SPIC, said that in the initial periods SPIC fertiliser plants had technical and other teething problems. In sorting out all such difficulties, the technical team of SPIC was able to gain deep insight and expertise in technicalities and technologies. It was this experience which had enabled SPIC to formulate SMO as a hardcore project consultancy wing.

Mr. Shah hoped that SMO would not offer only technical services but would also develop indigenous technologies which help industries. He further suggested that high tech organisations like SPIC-SMO should develop teams of commandos for different industries and train people.

Welcoming the gathering, Mr. S. Ramayya, Chief Executive of SPIC SMO, said that this workshop was unique since it was the first facility to offer maintenance services, diagnostic studies, inspection facilities and condition monitoring all under one roof.

He said the fully integrated SPIC-SMO workshop was ideally located on the Thane-Belapur industrial belt to meet the requirements of the major process industries in the region and was backed by fully trained and experienced engineers and technicians.

Mr. S. N. Narayanan, Regional Manager, SPIC-SMO, proposed a vote of thanks.

GREEN HOUSE EFFECT :

Prospects frightening for world climate

The accumulation of carbon dioxide, which has been identified as the global environmental crisis, resulting in the 'green house effect', would disrupt the earth's climatic system by 2030 A.D. according to Dr. Rashmi Mayur, director, Urban Development Institute of Bombay.

Dr. Mayur was delivering the key-note address on the opening day of the three-day meet on "global problematics concerning environment, technology and development and human responsibility", sponsored by the United Nations.

Perth in Australia was the only city taking precautions to stop all development along its coast and the US government had called upon scientists to find out the extent of carbon dioxide accumulation and suggest steps to prevent it, he said.

Dr. Mayur said the rise in sea levels would lead to massive flooding of all coastal areas, affecting lives of common people, especially in the Third World. Large tracts of the U.S. are expected to turn into barren areas.

As a first step, the exploitation is to be checked and rain forests preserved, he said.

India loses 1.6 million hectares of its rain forests every year and by the end of the century, only five per cent of the land would be covered by forests. This would also destroy about 20 per cent of life by industrial pollution, which destroys soil, forests and affects public health all over the world. About 10 billion tons of top soil, essential for agriculture, are washed away every year degrading 60 per cent of land leading to the advent of the deserts and declining food production he said.

The influx of millions to cities from rural areas could not be stopped unless population growth is checked, Dr. Mayur said. More and more people would live in squalid conditions and the quality of life would deteriorate.

Cities like Bombay, Sao Paulo, Lagos, Jakarta and Mexico city are on the verge of collapse. Bombay with a population of 10 million represents the failure of urban life. By the end of the century its population would rise seven fold to 70 million, he said.

It is estimated that 42 per cent of the people in the world now live in cities and the figure would go up to 52 per cent by the end of the century. By that time 35 per cent of urbanites would be living in slums and the only way to stop this mass migration is to create facilities for people in rural areas, as has been done in Japan, he said.

Starvation stares in the face of 800 million people today, to counter which a world food plan should be prepared. food banks created and preservation and storage of food emphasised, he said. He added that greater efforts to wipe out illiteracy and more efficient resources management should be evolved to save posterity.

GUJARAT SEEKS HIKE IN CRUDE ROYALTY

Gujarat is sore over ad hoc, arbitrary and unscientific fixation of royalty on crude oil on the basis of administered price for transfer of crude oil from the ONGC to the refineries by the Union Government successively during the last few years since 1976.

The net result is that crude oil producing States like Gujarat are not given royalty on the basis of the net worth of the resources exploited by ONGC. Unfortunately, the unscientific method of fixation of royalty after deducting sales tax, royalty and oil development cess from the price of crude oil results in deprivation of considerable amount of revenue which should legitimately accrue to Gujarat.

Thus, the benefits of natural resources are not available to Gujarat. It is understood that the State Government has submitted a memorandum to the Union Government demanding royalty on crude oil at the rate of Rs. 683.50 with effect from April 1, 1987, but the matter is still under consideration of the Union Government.

Polluting units told to mend ways

The Minister of State for Environment, Forests and Wildlife, Mr. Z.R. Ansari, has lambasted the Indian industry for turning a blind eye to environmental problems and has threatened action it fails to mend its ways immediately.

The Minister's warning came at the inauguration of a two-day seminar on "Available technologies for effluent treatment" organised by the Federation of Indian Chambers of Commerce and Industry (FICCI) and the All-India Distillers' Association (AIDA).

Mr. Ansari said there were two options left before the Government in case the industrialists failed to come out with a timeframe on pollution control soon. The options, he said, were "either to sign our own death warrants or to stop industry and save our future generations."

Mr. Ansari left it to the industry to take the decision.

The Minister said the Government was not against any particular industry but wanted that progress in industrialisation should not be at the cost of environment.

In an oblique reference to the speech of the AIDA President, Mr. Pritam Singh Sandhu, he said the typical argument raised by industrialists was that whatever investment was being made in pollution control was unproductive. This, the Minister found, to be an untenable and unacceptable logic.

Earlier, Mr. Sandhu had mentioned that standards fixed for distillery effluent were rather harsh and seemed difficult to achieve through available technology.

Mr. Ansari refuted this argument by saying cost-effectiveness was not a viable excuse in the face of environmental hazards. Whatever technology was available had to be made use of. Environmental control could not be compromised on grounds of suitable technology, he added.

Mr. Ansari in fact challenged the distilleries on effluent control measures adopted. He said he was sorry to note that assurances were being given constantly on adoption of control measures. While challenging the veracity of such assurances, he said he was looking forward to the day when no assur-

The Bhopal tragedy was a living assurance for all times to come, he said. He reminded the gathering that being Indians everyone had to live in this country." Our fruits of development must be shared by the future generations," he added.

The Minister called upon the FICCI President, Dr. S.K. Somaiya, to draw a forum for research work in updating technology. He exhorted the industry to take up the issue so that the message could percolate down to every unit in the country.

The Minister's plea was well responded by the industry The FICCI General Secretary. Mr. P.H. Pai Panandikar, announced that FICCI would soon set up a cell for technology upgradation for effluent control.

Earlier, Dr. Somaiya in his address said choice of a wrong technology could prove to be a very costly mistake. He was referring to the high costs and unsuitable technology available at present.

Dr. Somaiya called upon the Government to set out a phased programme for achieving standards. At the first stage, the standards set should be easily available given the technology. At the second stage, the standards may be gradually fine tuned.

Mr. Pai Panandikar, in response to the Minister's warnings said the seminar had started on a right note. He further said, he would like to make a commitment on behalf of FICCI and AIDA on a time-bound programme after a thorough study.

The seminar, was attended by over 150 representatives from the Government, industry and the scientific community on the opening day.

ENVIRONMENTAL POLLUTION : MECON SETS UP CONTROL LAB

The Metallurgical and Engineering Consultants (India) Limited (Mecon) has set up an in-house pollution control laboratory making in-roads in the field of environmental engineering.

Mecon sources said the company had launched handling monitoring technology jobs at six different places simultaneously.

Mecon has undertaken environmental impact assessment study and environmental management plan for the five cement plants and three limestone mines.

It has also secured a number of jobs in the area of monitoring of pollutants at lead zinc smelter of Hindustan Zinc Limited (HZL), Vizag, forecasting of sulphur dioxide level from the galvalume plant at Bharatpur and induced environment for acoustics and noise pollution in the defence sector.

The company was also engaged in monitoring of waste at the Indian Iron and Steel Company (IISCO), Burnpur, the sources said.

Mecon's environmental engineering wing was based on advanced technology drawn from TUV Rheinland of West Germany, one of the world's frontline organisations in environmental protection and quality control.

The sources said pollution control systems in India failed most often as the designs were based on assumed design data drawn from foreign sources which were not fully applicable to Indian conditions and needs.

Actual ambient and stack monitoring data from the field were used as base data to design a variety of pollution control systems, the sources said.

For accurate prediction of ambient air quality and aerodynamic balancing of dust and fume extraction systems Mecon had developed its own programmes on its in-house computer system Univav-12,100/60 CL.

The prediction of ambient air quality from multiple sources for critical and predominant meterological conditions was performed to yield information short and long term ground level concentration, they added.

TILAKNAGAR DISTILLERIES

The Maharashtra-based Tilaknagar Distilleries and Industries Ltd. will soon enter perfumery and cosmetics line. Negotiations with foreign collaborators are in an advanced stage.

Speaking to newsmen at Hyderabad, Mr. Arun Dahanukar, Managing Director said that the company will have a French collaboration for the manufacture of high-quality perfumes. In addition, after-shave lotions and allied range will also be produced.

The company has launched in Andhra Pradesh its courier Napoleon brandy, manufactured with imported concentrates and hopes to set up facilities indigenously for making the French type brandy.

Oil refining capacity shortage costs dearly

Shortage of refining capacity has proved costly for the country, now relying on higher levels of imports of petroleum products, and crude oil to meet the domestic demand.

Net imports of petroleum products in the current financial year are officially estimated at five million tonnes, three million tonnes more than the previous year.

However, net imports of crude oil are placed at 18 million tonnes, almost the same as the previous year. Domestic crude production has remained stagnant at around 30 million tonnes a year for the past year.

The import bill for 23 million tonnes of crude and petroleum products in the current financial year is expected to be Rs. 4,500 crores, an increase of Rs. 1000 crores over the previous year.

Compared to crude oil, importing petroleum products is difficult and more expensive. Providing refning capacity to process imported crude oil would help meet the demand for petroleum products in the country.

The total consumption of petroleum products this year is expected to be 50 million tonnes as compared to 46 million tonnes in the previous year.

The current refining capacity in the country is only 48.70 million tonnes, including a swing capacity of two million tonnes in Hindustan Petro Chemical Ltd's Bombay refinery.

With a throughput of 48 million tonnes of crude, indigenous availability of products from refineries may not be more than 45 million tonnes, allowing for export of surplus products.

Even with the Mathura and Koyali refineries, completing their schemes for expansion and clearing bottlenecks — by the end of this year the refinery capacity can only rise to 51 million tonnes. The throughput of crude may then rise to 50 million tonnes and net supplies of refinery products to 45 million tonnes, allowing for exports.

Meanwhile, the overall petroleum deficit will grow from the present level of five million tonnes to 21 million tonnes by 1994-95.

According to the current assessment, the total refining capacity is expected to increase to 60 million tonnes by 1994-95 with the completion of the proposed Mathura and Mangalore refineries in the joint sector.

The country would require a refining capacity of 75 million tonnes by 1994-95 and 100 million tonnes by the end of the century to meet atleast 80 per cent of the requirement for petroleum products from indigenous sources.

The failure to create additional refining capacity during the current plan has been a costly mistake, according to oil industry sources.

The Karnal and Mangalore refineries were to be completed by the end of the Sixth Plan.

But the additional nine million tonnes refining capacity from these two refineries would now be availeble only by the end of the Eighth Plan (1994-95)

The setting up of a refinery requires a lead time of five years after all necessary clearance and mobilisation of funds.

As the country is already facing a shortage in refinery capacity the Government has set up a committee to recommend the creation of additional refineries to match the demand of petroleum products.

The total capital investment required for additional refining capacity, crude and product tankage and various other distribution facilities by the end of the century is estimated at Rs. 25,000 crore.

At current prices, the capital investment required for new refineries has increased tremendously. In 1982, IOC established the six million-tonne capacity Mathura refinery at a cost of Rs. 251 crores, while the investment for the similar capacity refinery at Karnal will be about Rs. 1500 crores.

The project cost of setting up a refinery, at current prices works out to about Rs. 300 crores per million tonnes of crude throughput.

However, some of the existing coastal refineries could be expanded at an average cost of about Rs. 100 crores per million tonnes crude throughput.

Oil industry sources point out that the Government could allow expansion of the Visakhapatnam,Cochin, Madras and Haldia refineries as an urgent short-term measure to overcome the refining shortage.

Karnal refinery-a non starter

The six million-tonne prestigious Karnal Refinery project, launched by the Prime Minister, Mr. Rajiv Gandhi, with great fan-fare in March last year just before elections to Haryana Assembly, has remained a non-starter so far. According to informed sources, going by its tardy progress till now, the project has already suffered a time over-run of about a year.

The progress of the project can be gauged from the fact that the detailed project report (DPR) for Karnal Refinery was only finalised in May this year — almost 14 months after the launching of the project by the Prime Minister.

The jinxed project was sanctioned by the Cabinet way back in 1984. However, the Government took almost three years to decide the modalities to implement it, including the crucial question whether to go in for a joint sector or take it up as public sector project.

The approaching elections to Haryana Assembly last year forced the Government to take a speedy decision and launch the project. However, the subsequent Congress (I) rout at the hands of Lok Dal-BJP combine has thrown a damper on the Centre's enthusiasm to implement the project at the desired pace.

Following finalisation of DPR in May last, a technical team from Indian Oil and Tata Chemicals, the two partners of the joint venture company (JVC) created to implement the project had visited the USSR to discuss the import of Soviet equipment on rupee payment. The Soviet credit and equipment is in accordance with the November, 1987 bilateral agreement between the two countries.

According to the DPR, the Karnal Refinery project shall cost Rs. 1400 crores at current prices. The foreign exchange component is anticipated at Rs. 450.50 crores. The revised cost takes into account inflation since the earlier approval of the proposal and the minor changes in scope of the project which became necessary while firming-up the design and processes scheme. However, informed sources say that the project is expected to suffer cost over-run following delay in its completion.

Financing of the project is on the basis of debt: equity ratio of 4:1. Of the total share capital of about Rs. 280 crores, 52 per cent will be shared equally between the co-promoters — Indian Oil Corporation and Tata Chemicals. The balance would be raised from the public including non-resident Indians. The issue of convertible and non-convertible debentures has also been envisaged.

The Karnal Refinery located at Baholi, eight km from Panipat and about 40 km south-west of Karnal will have flexibility to process both imported and Bombay High type of crudes. The crude oil will be transported through a new 315-km branch line from Chaksu (Rajasthan) on Indian Oil's existing Salaya-Viramgam-Mathura pipeline of 1290 kms. The entire pipeline project would be under taken by Indian Oil. All formula products produced by the refinery will also be marketed by Indian Oil.

The delay in the completion of Karnal Refinery will further add to the already serious problems of meeting the demand for petroleum products in the north-western region in particular.

The deficit of light ends, comprising mainly naphtha and motor spirit, for the country during the Eighth Plan (1994-95) has been projected at 1.6 million tonnes. This deficit is likely to go up to 7.7 million tonnes by the end of the Tenth Plan (2004-05).

Against the total consumption of petroleum products estimated at 50 million tonnes this year, the refineries in the country are expected to process about 48 million tonnes of crude and provide about 45 million tonnes of finished products. Thus there will be a shortfall of about five million tonnes of petroleum products. The total refining capacity in the country is expected to increase to 60 million tonnes by 1994-95.

The country would require a refining capacity of 75 million tonnes by 1994-95 and 100 million tonnes by the end of the century to meet at least 80 per cent of the requirement of the petroleum products from indigenous sources.

IOC, ASSAM GOVT TO BUILD REFINERY IN E. REGION

The Assam Government and the State-run Indian Oil Corporation (IOC) will shortly enter into an agreement for setting up a two million tonne-refinery in the eastern part of the State.

Informed sources said that initally the Assam Government harboured an idea to set up the refinery in the joint sector as envisioned by the 1985 Assam Accord. The idea had to be abandoned as there was no sufficient response to the proposal from the private sector.

The sources said negotiations between the Assam Government and IOC has reached the final stage. A decision to this effect is expected around this year-end.

The sources also said the Centre has set up a committee with representatives drawn from Engineers India Ltd. IOC and the like to assess the growth of petroleum products around 2004 AD and suggest measures as to how to cope with the spurt in demand by expanding refining capacity.

The committee would also evaluate the recommendations of the committee on supplies measures set up by the Petroleum Ministry. Coming into operation about one year ago, the committee made its recommendations to the Government around March-April.

According to the sources, the Government's tentative thinking is to set up at least one refinery either in Central India or in the country's eastern coastal region during the Eighth Plan.

Meanwhile, at a press conference, Mr. B. K. Bakshi, IOC, Director (Marketing) and Mr. T.P. Raghavan, General Manager (Eastern Region), said the Corporation has undertaken a Rs. 132-crore programme to step up its marketing in the region.

Outlining the programme, Mr. Bakshi and Mr. Raghavan said the Corporation has already invested Rs. 50 crores for three bottling plants at Durgapur (II phase), Jamshedpur and Balasore. While Durgapur phase had been commissioned, the other two plants would come into operation shortly.

This apart, an estimated Rs. 62 crores would be expended on creating an additional 2.75 lakh litre storage facility by 1993, up from the present 8,000 lakh kilo litre.

RS. 516-CR. DEBENTURE ISSUE :

Reliance Petrochem to enter market

Reliance Petrochemicals Limited is scheduled to enter the capital market with a fully convertible debenture issue of Rs. 516 crores towards the close of the next month. This will be the largest ever capital issue by any private sector company in the corporate history of the country.

Reliance Petrochemicals Limited (RPL) has been promoted by Reliance Industries Limited to set up a petrochemical complex at Hazira in Gujarat. The capital investment on the complex is placed at Rs. 700 crores. The company has plans to take up the second phase involving an investment of Rs. 1,000 crores after a few months. The complex is expected to commence production towards the end of 1989.

Half of the proposed issue of 2.58 crores debentures of Rs. 200 each at par for an aggregate amount of Rs. 516 crores will be offered to shareholders of Reliance Industries on preferential basis based on their holdings in RIL, and the other half will be offered to the public. The debentures will carry interest at the rate of 12.5 per cent per annum.

According to the terms of the debentures, five per cent of the face value of each debenture, i.e. Re. 10 per debenture, will be converted into one equity share of Rs. 10 at par on allotment. Another 20 per cent of the face value i.e. Rs. 40 per debenture, will be converted into equity shares at a premium as may be decided by CCI after five years but before the end of seven years from the date of allotment.

The company will be entitled to retain additional subscriptions as may be permitted by the controller of capital issues.

On current reckoning, it is felt that a total of about 12 shares of Rs. 10 each will be made available to full conversion of each convertible debenture.

Reliance Industries will be contributing Rs. 50 crores by way of equity capital and another Rs. 50 crores by way of interest-free unsecured loans, which will be later converted into equity.

The earlier 'G' series RIL debentures fetched as many as 17 lakh applications for debentures worth Rs. 1,100 crores. RIL has a total of 27 lakh shareholders.

The implementation of RIL's projects — the company has already in its hands three licences for the purpose and some other proposals are pending with the government — are expected to substantially reduce dependence on PVC, MEG, and HDPE imports.

SPOTLIGHT ON

Biotechnology & Life Sciences (Part 2)

THE ENZYME LYSOZYME ADAPTS TO VARIOUS FUNCTIONS IN DIFFERENT SPECIES

The enzyme lysozyme has various forms (by developing different amino acid sequences) in different species. In most mammals, lysozyme is found in tears, saliva and white blood cells, where it serves to fight invading bacteria by breaking down the bacterial cell wall.

Ruminants such as cows and sheep have put lysozyme to another use in coping with their high cellulose vegetarian diet. Their specialised "foregut" serves as a fermentation chamber, in which bacteria break down cellulose; in the stomach proper the bacteria themselves are digested with the help of lyzozyme. The same digestive specializations arise independently in the leaf-eating colobine monkeys, among them the langur. (*Scientif. America,* 2/1988 p.14).

A NEW FAT-DISSOLVING ENZYME FOR DETERGENTS DEVELOPED BY NOVO INDUSTRY (DENMARK)

Novo Industry (Denmark) has commencd production of fat-dissolving enzyme as an additive to detergents, trade-named Lipolase and will be produced in Novo's factory at Hokkaido, Japan.

To date, enzymes in laundry products have been limited to proteolytic enzymes, which break down and solubilize proteins such as egg particles and blood and to amylases that are effective against starch containing stains. Lipolase will be effective against such stains as body oils, cosmetics and edible oils.

The main problem associated with adding lipases to detergents is that they are inactivated under the high pH conditions of commercial washing products. Novo scientists have succeeded in identifying a mold-produced lipase that not only is stable but functions at optimal biological activity at pH 9 or higher. The gene that expresses this enzyme has been isolated and transferred to an aspergillus mold. Also important from the commercial standpoint is that the lipase is produced at sufficiently high yields to make the development commercially viable.

Lev Hepper, an authority in industrial enzymes, reports Lipolase should have little trouble passing through health and safety regulations. The aspergillus strain used for making Lipolase is already used for making many food ingredients. Hepper estimated market for lipase in detergents to grow to $100 million or more a year. Lipolase will be available to customers by the end of 1988 or early 1989 in Japan, USA and W.Europe. (*C&EN* 2/8/88 p.8).

BIOTECHNOLOGY IN BRITAIN — AN UPDATE

Britain is a leading nation in the new discipline of biotechnology, next only to USA and Japan. The basic research leading to the development of the new discipline of biotechnology was pioneered at Cambridge University in the 1950s. To-day there are more than 100 companies and several public sector organizations in Britain engaged in biotech research. However, to date, relatively few biotech products have reached the market. The very novelty of this technology has raised many problems, not the least of which is the transfer of small scale lab techniques to the production line. Other hurdles are of an ethical and environmental nature. The Advisory Committee on Genetic Manipulation operates in Britain, a voluntary approval scheme for researchers to help them avoid potentially dangerous experiments. Biotech drugs are also subject to the normal testing procedures for approval by the drug authorities.

Only the larger chemical and pharmaceutical companies have not been deterred by the research costs of biotech products. These include ICI, Wellcome, Glaxo, Beechams, Unilever, and Shell. Fields of specialization for smaller biotech firms in Britain include medical diagnostics, plant breeding, microbial pesticides, waste treatments, and production of special enzymes. Many of these firms are engaged solely in contract research and/or consultancy, either for larger concerns or as part of projects sponsored by the Government, or the European Community.

The Laboratory of the Government Chemists, run by the Dept. of Trade & Industry (DTI) has a special Biotechnology Unit and has directly financed more than 30 research projects with companies, notably in the fields of biosensors, agriculturals and food products. Other state finding for research goes through the research councils and government organization. An example of such cooperation is the DTI's Microbial Culture Information Service, launched, in March 1987 to establish a computer database on the results of research in this field.

ICI has been among the European leaders in marketing biotech products, such as Biopol, the world's first biodegradable plastic, the animal food Prutech and a human food Mycoprotein (jointly with Ranks Hovis McDongall). The Company has also been expanding its seed business through a series of acquisitions in Britain and elsewhere since 1984 and hopes to create new crop varieties that will be resistant to infection and not requiring pesticides.

The largest British biotech company is Celltech, which was set up by the National Enterprise Board in 1980. This company has now become the world's leading producer of monoclonal antibodies (MABs), which are used in blood-group testing and in a variety of medical diagnostic procedures, treatments and research.

STURGE (UK) RESEARCHERS OBTAIN OIL OF JAVANICUS BY A BIOTECH PROCESS

J. E. Sturge (Selby, UK) reports that it has already spent over $10 million to develop the first commercial fermentation route for bulk production of an edible oil. This oil, called Oil of Javanicus, is a source of an important fatty acid gamma linolenic acid (GLA). GLA is a precursor to prostaglandins, which regulate a number of body functions, particularly within the circulatory system. Oil of javanicus is a mixture of fatty acid triglycerides and contains 16% GLA by weight, making it suitable for a wide range of applications in food, health products, cosmetics and personal hygiene.

In the biotech procedure (developed in conjunction with researchers at the University of Hull), oil of javanicus is obtained by fermentation using the microorganisms Mucor Javanicus and glucose from wheat starch; the oil is then refined to edible standards. Until now, reports Sturge, the major source of GLA have been oils extracted from the seeds of the evening primrose, borage and black currant.

CYCLOSPORIN-YIELDING FUNGUS IDENTIFIED BY ICMR RESEARCHERS

The chance discovery of a fungus at one of the Indian Council of Medical Research (ICMR) institutes have sent waves of excitement through the Indian pharmaceutical community. While screening soil samples for mosquito-killing agents, scientists at the Vector Control Research Centre (VCRC) in Pondicherry have stumbled upon a strain of the fungus Tolypocladium cylindrosporum that yields large amounts of cyclosporin — an immunosuppressant drug widely used for managing patients undergoing organ transplants.

Cyclosporin is manufactured and marketed by Sandoz, which obtains it from the fungus Tolypocladium inflatum. According to VCRC microbiologist Dr. K. Balaraman, a secondary metabolite in T.cylindrosporum produces an essentially similar product, as three week old fungal cultures. Animal studies are soon to begin to test the efficiency of the product which the VCRC is now able to produce in purified crystalline form. The ICMR is looking for an Indian company to undertake commercial production of cyclosporin. According to VCRC director Rajagopalan, the discovery of the above fungus is the best thing to have happened in the Indian drug scene in recent years (*Nature* 4/21/88 p.671).

FIELD TEST PLANNED FOR AN r-DNA PESTICIDE

A preliminary risk assessment by the US Environmental Protection suggests that Crop Genetics International Corp. (CGI) of Hanover, Md., will win approval for a small-scale field test of a genetically engineered microbial pesticide. The assessment, which was completed late last month, concluded that the CGI microbe has limited life in the environment and is unlikely to hurt nontarget organisms.

The next regulatory hurdle that the pesticide, a gene-spliced bacterial strain will have to cross is a full-scale review of CGI's test proposal by EPA's Biotechnology Science Advisory Committee. After that, EPA will have to rule on whether to let the test proceed.

CGI's microbial pesticide has less chance of migrating out into the environment because it is effective inside the plant (and, therefore bears the trade name Incide). With high pressure, CGI forces the gene-spliced bacteria through tiny cracks into corn seeds and the microbes grow with the corn. This makes spraying the corn unnecessary and also keeps the bacteria localized and persistant in the plant, points out CGI chairman John Henry. The bacterium chosen, Clambacterylis cynodontis has been genetically engineered to incorporate the gene from another widely used microbial pesticide Bacillus thuringiensis. The gene causes the bacterium to produce a protein that is toxic to the European corn borer, a pest that is blamed for $400 million in crop losses annually in USA. For this use Incide is viewed by CGI as an alternative to chemical pesticide, such as Furadan produced by FMC Corp. (*Chem. Eng.* 4/25/88 p.42).

A MICROBIAL SURFACTANT DEVELOPED TO RECOVER OIL AND FOR CLEANING CONTAMINATED SOILS

A natural product isolated from microorganisms developed to de-

rade highly chlorinated aromatic ompounds has proved an effective mulsifier that can be used to extract l from sludge in storage tanks. licrobes that develop metabolic athways for degrading hydrophobic hlorinated chemicals must also roduce some sort of surfce active gents opined researchers in the ourse of their research. They par-ally purified the emulsifier — a gly-oprotein — produced by a strain of seudomonas that had mutated so could thrive on the herbicide 2,4,5 - trichlorophenoxyacetic acid.

The above finding was reported by nanda M Chakraborty, (professor f microbiology at the University of linois' College of Medicine) at the ecent annual meeting of American ssociation for the Advancement of cience (AAAS).

The surfactant has been used uccessfully by Petrogen Inc. Arlington Heights, Ill.) to recover 0% of the oil trapped in sludge at ne bottom of oil tanks in Kuwait. hese microbial surfactants are oing to be useful in future for recov-ring oil and for removing highly oxic hydrophobic chemicals from ontaminated soils. (*C & EN*, /22/88, p.18).

A RESEARCH PROJECT FUNDED TO DEVELOP MEMBRANE FOR BIOTECH SEPARATION

Using membranes to slash the osts of biotechnology separations y half is the aim of a six month 50,000 National Science Founda-ion (USA) contract to Bend esearch Inc. (Bend. Oregon). Paul an Eikeren of Bend Bioprocess ivision explains that ammonium-on waste products foul many bio-ech fermentation processes, naking it necessary to replace the ngredients continuously. This nakes it very costly to produce omplex proteins, such as monoclo-nal antibodies, interferons, hormones and enzymes. Bend researchers will employ hollow fibre membranes to remove wastes from the cell culture continuously. Van Eikeren reports that many proprietary membrane materials will be employed, depending on the composition of the fermentation broth. The researchers aim is to select a proper membrane. The surfactants and varied products contained in cell cultures can affect the membrane flux and selectivity (*Chem Eng.*, 4/11/88, p. 18-19).

BIOTECH PRODUCTION OF LAURIC ACID FROM CUPHEA PLANT ON THE HORIZON

The prospect of plant origin as a domestic source of lauric acid in USA is nearing, reports Dr. Stevens J. Knapp of Oregon State University, thanks primarily to a research partnership established between Soap & Detergent Association (SDA) researchers at Oregaon State University and USDA. This optimistic forecast stems from the steady yield of results from Oregon State's cooperative cuphea domestication research programme.

According to Dr. Knapp, Cuphea domestication is the most practical, immediate and least expensive way of achieving domestic lauric acid production. In seeking the programme's goal of optimizing production, seed yields and actual lauric acid yield, Dr. Knapp confirms that combine harvesting is more than four times as efficient as vacuum method when harvesting the 'non-shedding' cuphea.

Though domestication of cuphea is not dependent on breeding the non-shedding variety, production of the genetically engineered strain could increase seed yields from 200 to 300 percent according to Dr. Knapp. He further reports that the induction of the genes necessary to obtain the non-shedding plants has been demonstrated through the use of chemical mutagens both conventionally and via biotechnological techniques. The two routes are about equally efficient.

The preferred way to heighten the economic viability of lauric acid yield, Dr. Knapp emphasizes, is selection. For example, the programme has selected the upper 10 percent of the germinating (cuphea laminuligera) and created a population with reduced seed dormancy and therefore increased seed yields. However, Dr. Knapp does not exclude the importance of biotech means but asserts that the most immediate way to lauric acid production is selection (*CMR*, 2/15/88, p. 32).

EMULSIFIERS BY DESIGN ON THE HORIZON

In a remarkable improvement on nature, a protein engineer at the Institute of Food Research (IFR) has designed a new class of emulsifiers, but by using first principles to come up with a completely novel polypeptides. The new emulsifiers — alpha-helixes in which hydrophilic and hydrophobic amino acids are completely separated on opposite sides of the molecules — are smaller and more effective than natural protein emulsifiers.

Chris Brock at the IFR's Bristol Laboratories, who developed these amphipathic polypeptides as part of an investigation of the mechanism of emulsification, reports their likely cost will make them candidates for use in higher-added-value pharmaceuticals and cosmetics. Brock is trying to patent a series of these compounds and has had several enquires from food companies interested in developing commercial products. Brock reports that a lot is already known about the three

dimensional structure of alpha-helixes and its relationship with the sequence of amino acids. Some of the emulsifiers are twice as active as natural ones, and stabilise oil and water emulsions up to eight times longer.

The researchers built additional stability into the polypeptides by including intra molecular salt bridges between neighbouring but oppositely charged amino acid residues on the hydrophilic side of the helixes — like extra vertical supports on one side of a spiral staircase (*Chem. & Ind.*, 2/1/88, p. 63).

GENETIC ENGINEERING — ITS IMPACT ON AGRICULTURE

There is a general apprehension about genetic engineering and its impact on agriculture. Many adopt the view that genetic engineering is dangerous, unnatural and in some way infringes on 'divine copyright'. This concern promises to delay the application of biotechnology to agriculture.

There is not the slightest reason in the world to assume or hypothesize that changing a single gene in a corn plant by genetic engineering and planting its seed in the field would cause an environmental problem. So converting a corn plant into a weed would require a thousand genetic changes. It is absurd to pretend that we are living in a pristive forest and to say that we should not change anything. In the end, using biotechnology to control plant pests and to raise the agriculture production of the areas we have decided to cultivate may be the best way to leave other parts of the world unaltered

Indeed, if we cannot use tools like biotechnology to enhance the agricultural productivity of tropical lands that have already had their forests removed, deforestation will continue with profound consequences for the productivity and health of our planet.

It should be noted that honey bees, farmers and animal breeders have been recombining the genes of various organisms for millennia and the organisms freely roam the planet. Genetic recombination by Mother Nature or by genetic engineers is an ancient process.

Moreover, genetic engineering gives us an intimate view of how nature operates and allows us to work with nature. It has taught us to address nature in her own universal language, the genetic code, and nature has responded by producing proteins we have asked her to produce, like enzymes that dissolve blood clots in heart attack victims or proteins that enable plants to resist insects and diseases or proteins that improve the productive efficiency of livestock operations. Genetic engineering is a wonderful tool to enhance human life. Nature is finally scrutable and at long last, human beings can work in harmony with nature.

What is especially important to understanding what genetic engineering does is to recognize that a particular gene is essentially the same whether it occurs in a cow, in a corn plant or in a bacterium. The critical element is the protein that the gene makes. Moving a gene from one organism to another does not itself alter the characteristic of that gene and it is utter nonsense from a biological point of view to imply that moving genes from organism to organism, a process that has certainly been going on for over a billion years, is some how 'unnatural'.

Researchers will not be allowed to apply genetic engineering to agriculture without the support and interest of world leaders and of the public. The world will need rational, science-based regulations in each country in which these new agricultural methods are used. We need regulations which allow the application of this technology while meeting the goals of environmental protection and which permit the safe purposeful release of modified genetic material.

(Excerpts from Lecture of Howard A Schneiderman of Monsanto at a Conference on Science & Technology in Bellagio, Italy.)

NEW N-FIXING ENZYME

Researchers at the North Carolina State University in the US have discovered the existence of a third bacterial enzyme, nitrogenase, capable of converting atmospheric nitrogen to nitrates. This enzyme isolated from *Azotabacter vinelandii,* contains iron as the only significant metal ion present.

Until two years ago only one nitrogenase enzyme containing molybdenum was fully identified. In 1986 the AFRC nitrogen fixation unit in Sussex, UK, revealed the existence of the vanadium-based enzyme. All three enzymes are similar, each with an dinitrogenase unit and a smaller iron sulphur protein. The two newest however, may also possess a third.

Plant biotechnology firms are attempting to transfer the ability to fix nitrogen of certain bacterial species to plants. Transferring the genes responsible is not going to be an easy task as not all have been identified even for the first nitrogenase.

This effort is unlikely to bring forth manipulated plants until the next century but will cut the need for artificial N-fertilizers and will reduce the associated environmental concerns.

Expanding The Thermal Limits Of Glasteel® Equipment

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Abstract

The search for a chemical containment material should proceed logically by balancing out the limitations of the various candidate materials, thereby quantitizing expected performance, against the total equipment costs. For glasslined equipment, thermal limitations are frequently critical especially from the interaction standpoint, that is, as operational temperature increases, both the total corrosion rate and the susceptibility to thermal shock/stress often also increase. Modern technological advances coupled with the research leadership at The Pfaudler Co., Inc., Rochester, New York, have led to the development of a revolutionary new high temperature Glasteel® and the refinement of data for low temperature operation. The new Glasteel, called Pfaudler Ultra-Glas 6500™, offers markedly expanded upper glass operation limits (from 450°F to 650°F), along with improved thermal shock properties (up to 100°F in critical situations) without sacrificing corrosive resistivity.

Utilization of substrate steels/alloys with improved low temperature impact properties coupled with compatible glass systems has also expanded the low temperature limit from -20°F to -200°F. Consequently, both operational temperatures and heating/cooling rates for many chemical campaigns may now be significantly altered thereby allowing for more favourable yield/specificity-type kinetics.

The Marriage Of Glass & Steel

Glassed steel is an engineering composite in which powdered glass in slurry/dust form is applied onto already-formed base metal equipment, usually constructed of a low carbon steel. The glass is then fused to the steel by controlled-temperature firing. This process is repeated until the desired thickness/degree of voltage integrity is achieved. When Casper Pfaudler first combined glass with steel in 1884 in an effort to form a suitable container that could be used in conjunction with his invention for vacuum processing beer, he had no idea of the broad applications his materials innovation would someday have for the chemical process industries.

Now, just over 100 years later, the Glasteel® that bears his name is recognized as the industry standard. Pfaudler is the preferred name, especially in process applications where corrosion problems exist, in instances where the purity of chemical components is of utmost importance, where product adherence problems persist, or generally, where technical innovation and excellence are desired. For these reasons, Pfaudler Glasteel products enjoy widespread use in the chemical processing industry.

Why Glasteel Is Strong And Durable

The clue to why Glasteel is both strong and chemically resistant lies in its very name "Glasteel". This composite truly embodies the outstanding characteristics of the two base materials: the strength of steel and the corrosion resistance of glass. Freestanding glass is inherently weak in tension but extremely strong in compression. By judiciously utilizing the thermal expansion differential between a metal and a glass, a strength-imparting residual compressive strain can be set up in the glass portion, making it many times stronger than its free-standing counterpart.

Current Limitations Of Glasteel

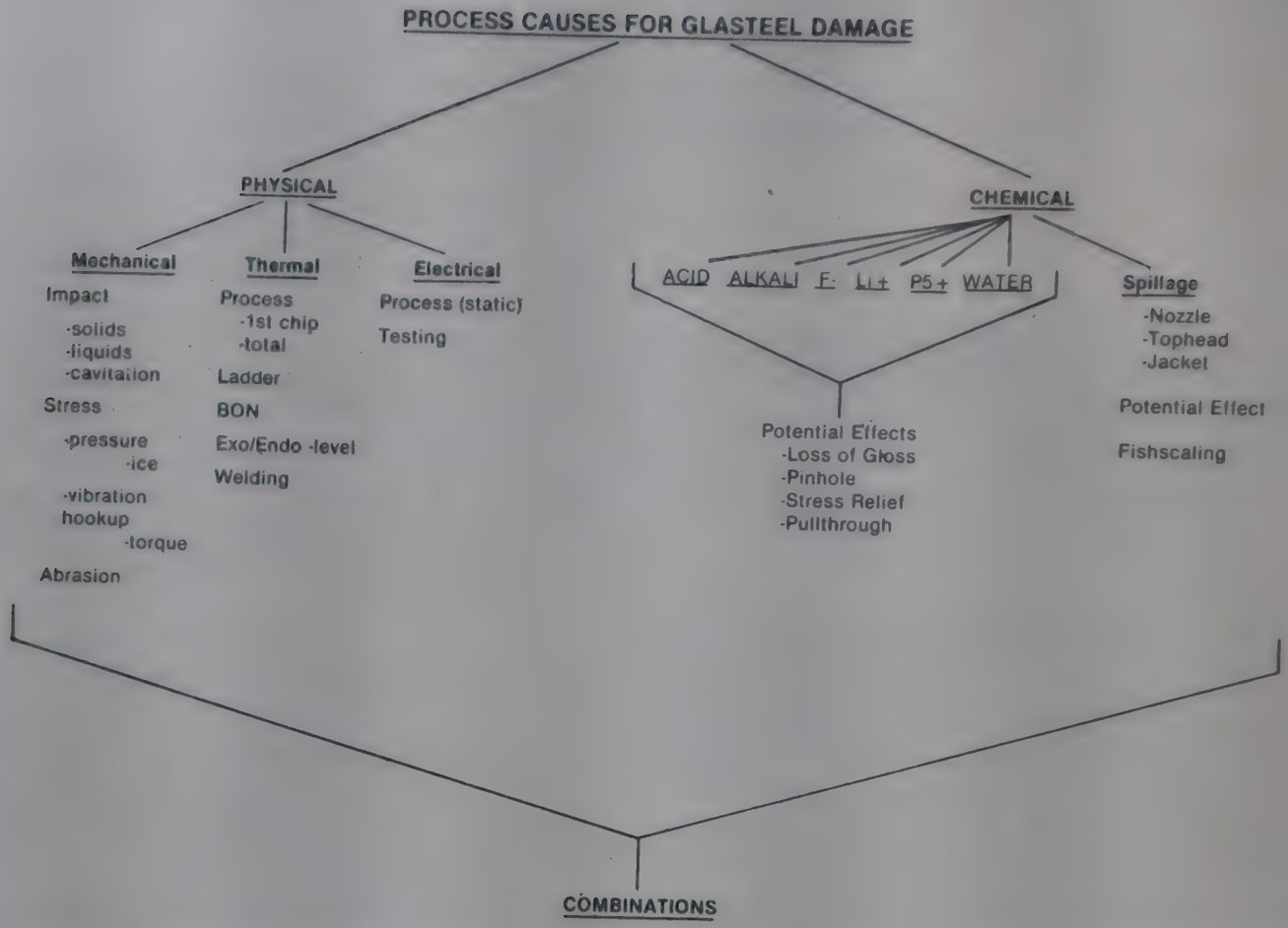
The limitations of Glasteel, and, consequently, the use ranges for Glasteel have been well defined by Pfaudler through extensive field analyses coupled with research/testing-type verification of the effect, cause, cure sequencing for Glasteel damage. These data, summarized in Figure 1, were first published in 1978 as part of the Pfaudler Corrosion Seminar and remain the industry benchmark for damage analyses.

In order that a more exact comparison with the new Ultra-Glas 6500 can be made, it is important that the use ranges of current Glasteels be first cursorily reviewed.

Corrosion Properties

The primary reason for the wide range of chemical resistivity of Glasteel compared to most metals lies in its

Fig.1



unique chemical makeup. Metals are high surface energy materials that tend to reach a lower energy state through the process of corrosion. As metals are electron conductive, the corrosion mechanisms are usually electrochemical, resulting in several distinct types of corrosive attack (for example: pitting, crevice, galvanic, intergranular, stress).

In contrast to metals, the glass coating of the Glasteel composite is a non-conductive mixture of low energy oxides that can corrode only by a self-limiting ion exchange reaction (acids) or by direct chemical solution (alkalis). Consequently, the corrosion rates of Glasteel can be accurately measured and valid predictions of service life usually made.

Acid Resistance

Outstanding acid resistance under extreme process conditions is a primary feature of Pfaudler Glasteel. Often Glasteel is the only practical material of construction for many acid services.

General Guidelines: To insure maximum service life of Glasteel equipment in acid environments, the following points should be considered:

1. Type of Acid — Glasteel is resistant to virtually all acid solutions at all concentrations to 250°F, and in many cases to 450°F. Exceptions are aqueous fluoride-containing solutions (at all concentrations and temperatures), and hot concentrated phosphoric acid. When handling mixed acids, the combined effect is generally no more severe than if either acid were handled alone. Certain small ionic species in aqueous solutions, e.g. Li, Mg, should be avoided at temperatures in excess of 160°F. Note that small quantities of an impurity may have a significant effect on the overall corrosion rate.

2. Temperature — At ambient temperature, most acids have little effect on Glasteel. However, rates of corrosion do increase with temperature. In most acids, changes in the corrosion rate are insignificant up to 250°F. Above 250°F, the rate varies for each acid.

3. Concentration — Very low concentrations (approximately 1%) of most acids have little adverse effect on Glasteel. Low acid concentrations are often recommended as they can inhibit the corrosive action of the condensing water vapor on glass and permit higher operating temperatures than for pure water alone.

Generally, concentration ranges up to approximately 40% result in maximum corrosion rates. At concentra-

ions above 40%, acid corrosion rates usually begin to decrease, resulting in excellent service at higher concentrations and temperatures (exception: phosphoric acid).

Alkali Resistance

Alkali and acid corrosion differ in that alkali attacks the silica network of glass directly and is limited primarily by controlling temperature and concentration.

Glasteel® 5000 exhibits good alkaline corrosion resistance. It can be used at room temperature at any pH value. As temperature increases, however, the pH value of the environment becomes a more significant factor, e.g., at pH 8 the limiting temperature is 275°F; at pH 14, it is 160°F.

Organic Media

Organic media usually do not pose chemical resistivity problems for Glasteel. However, materials with electrical relaxation times in excess of 0.1 sec. e.g., hexane, xylenes, toluene, benzene, heptane, either alone or in combination with other liquids, solids and/or vapor phases may lead to electrostatic discharge within the liquid, between the liquid and vapor, or between the liquid and the vessel walls or accessories. The static sparking could cause ignition of a flammable vapor and/or in the case of Glasteel, pinhole-type breakdown of the protective glass coating. Note that static discharge can occur in a grounded metal vessel.

Spillage

The acid corrosion of the base metal through spillage/jacket cleaning can lead to fishcaling damage. The corrosive reaction causes hydrogen gas to form which permeates through the steel causing pressure build-up at the glass/metal interface and eventual glass chipping.

Mechanical Properties

The mechanical strength of Glasteel is directly related to the aforementioned degree of residual compressive strain originally built into the system. In order for glass fracture to occur, this compressive cushion must be overcome by the addition of positive type tension strains. There are four major factors which can affect compressive strain:

1) Glass thickness — surface compressive strain decreases with increasing glass thickness. Optimum values are set by the manufacturer.

2) Geometry — compressive strain decreases in the order: concave; straight side; convex. The manufacturer always attempts to maximize convex radii.

3) Other positive tensile strains, e.g., impact, abrasion. (see section below.)

4) Temperature — compressive strain decreases with increases in temperature. (see section below.)

Impact resistance

As a general guideline, Glasteel will fracture to 5KV electrical contact when subjected to an energy of 9 in.-lbs. The impacting influence on a Glasteel can result from the interaction of solids, liquids, or vapors. Factors like density, momentum, area of contact, geometry, etc., greatly complex the exact energy-fracture relationship especially for solids.

Damage resulting from liquid impacting is primarily associated with the "jet cleaning" of Glasteel equipment. If suitable solvents cannot be found, it is an acceptable method to clean glass provided that certain rules are followed. These include: keeping nozzle pressure below 2000 PSI; keeping the glass to nozzle distance greater than 12 inches; keeping the glass contact time to a minimum; avoiding critical areas, such as convex radii, surface fractures, or repairs; protecting the manway; and, filtering the cleaning fluids.

Problems with vapors, more commonly termed cavitation or collapsing vapor bubbles, have been realized by Pfaudler since 1974. It was found that large energies can be generated simply through the collapse of vapor bubbles. For instance, a collapsing 1-inch diameter bubble can generate energies in excess of 100 in.-lbs.

Common causes of cavitation include: steam sparging; exothermic reactions, especially through dip pipe mixing; and agitation of low boiling, high vapor pressure components.

Abrasion Resistance

The best measure for the abrasion resistance of Glasteel is through the use of a differential hardness scale, such as the Moh scale. This logarithmic scale runs from 1 for talc to 10 for diamond. glasteel is 5.5. Any material higher in value may abrade Glasteel. This measure is complexed by; a large number of factors, for instance, liquid media; particle size/distribution; particle angularity; and concentration. Testing must be done to insure

serviceability. The combination of abrasion with corrosion can be particularly troublesome. As the abrading material can rapidly remove the barrier corrosion film, the combined rate of attack can be high.

The concentrated forces usually associated with both impact and abrasion make significant differentiation among different pure glass on metal systems difficult to practically realize. However, through a controlled heating process, high strength crystals can be grown within the glass to form the Nucerite® system. This system, first developed by Pfaudler in 1958 with continued improvements to date, shows a doubling of the impact resistance and a fourfold increase in abrasion resistance.

THERMAL PROPERTIES

Temperature

Temperature is often the most critical of the various operational parameters in a chemical campaign. Rates of reaction, product yield, and compound selectivity are all closely tied to it. Reaction temperature and the rate of thermal application frequently dictate which containment material can be used. Ofttimes, the optimum temperature profile cannot be achieved due to thermal limitations.

Upper Use Temperature: The current upper use temperature of 450°F for Glasteel was established in the 1950's and was predicated on several interactive limitations, namely:

1) Thermal shock limits generally decrease as temperature increases. Consequently, the possibility of thermal failure also increases proportionately at higher temperatures.
2) Corrosion rates ofttimes become prohibitively high above 450°F.
3) Peripheral operational equipment/materials, e.g., gaskets, seals, stuffing boxes, paint, repairs may also have limitations.

It should be noted that several companies working closely with Pfaudler have successfully operated Glasteel equipment above 450°F, but only after careful consideration of all these limitations had been made and the appropriate corrective approaches worked out.

Lower Use Temperuature: The substrate metals most commonly used to make Glasteel equipment are designated by ASME as SA285 Grade B, SA285 Grade C, SA515 Grade 65, and SA516 Grade 70. Most Glasteel equipment is built to conform to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. This Code has designated the use temperature range for all these steels from -20°F to 650°F. It should be noted, that while the current upper temperature limit is partially dependent on the properties of the glass, the lower limit is strictly a function of the metal. Temperatures below -20°F are allowed provided appropriate pressure reductions or specific low temperature testing is carried out in compliance with Code directives.

Thermal Shock Limits: As the name implies thermal shock refers to the relatively rapid application of a thermal differential to the Glasteel. There are several possible situations involving the loading of either the vessel or jacket with thermally differing material that could lead to thermal shock damage. Of these, the four cases depicted in Figure 2 are the most common.

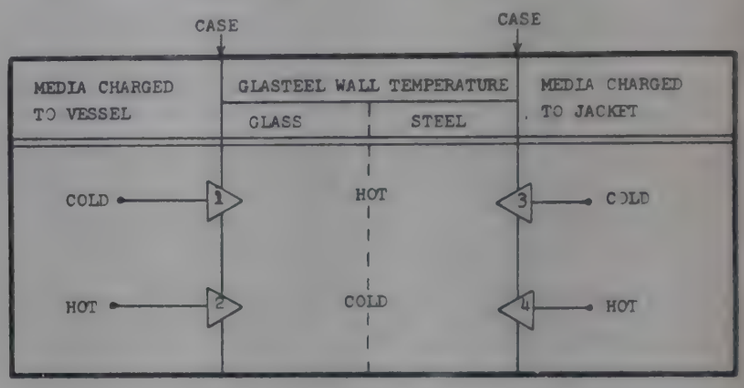


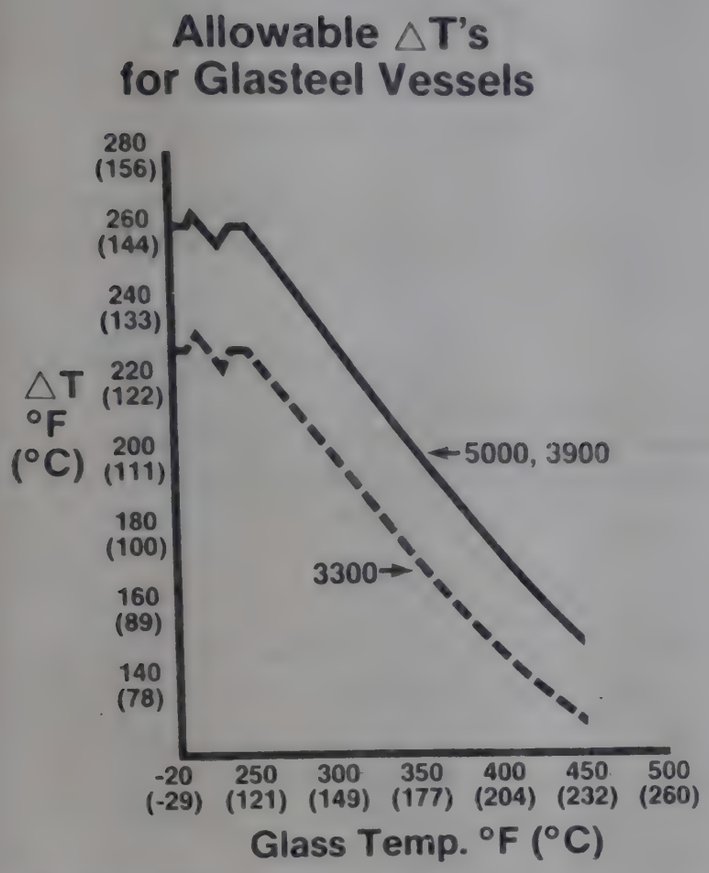
Fig. 2: The Four Common Cases For Thermal Shocking Glasteel

Of the cases #1 and #4 are the most critical as they both tend toward reducing the residual compressive strain the greatest.

While the other cases are not as sensitive, it is most prudent, from a service life standpoint, to treat all the cases similarly. Thus, the allowable thermal shock differential limit ($\triangle T$) should be reduced when operating at glasswall temperatures between 250°F and 450°F. This relation is shown in Figure 3 for several Glasteel formulations.

For example, assume a Case #1 situation with the Glasteel 5000 wall temperature at 400°F. What would be the minimum charge temperature for the media to the vessel? From Figure 3, the allowable $\triangle T$ is 170°F. Therefore, the minimum charge temperature would be 400°F — 170° = 230°F. Any temperature lower than this could cause thermal damage. For a Case #4 situation, again with the wall temperature at 400°F, the maximum charge temperature for a jacket media would be 400°F + 170°F = 570°F. Anything above this could again cause thermal damage.

Fig. 3



Thermal Stress: Thermal stress is failure caused by differential heating and cooling that is not necessarily instantaneous in nature. Thermal stress occurs where one section of a vessel is hot and an adjacent area is cold. This difference in temperature sets up a stress at the interface between the hot and cold areas, a stress that can be sufficient enough to break the glass. There are two rather unique types of thermal stress failure that should be mentioned:

Bottom Outlet Nozzle (BON) Failure: The bottom outlet area is perhaps the most critical area influencing potential thermal failure in the entire vessel. The convex geometry of the BON, the restraining influence of the diaphragm jacket ring and the temperature differential between jacketed and non-jacketed areas are contributing factors to its vulnerability. Coupled with this are the usual nozzle loading forces.

A frequent damage scenario occurs in steam heated batch systems where the vessel cools between batches and condensate collects in the bottom of the jacket. The vessel is then charged with cold liquid and the steam turned on to maximum pressure. The combination of the cold jacket condensate and cold liquid in the vessel outboard of the jacket diaphragm causes tremendous thermal stress in that area, leading to glass fracture in the convex radii area of the BON followed by a circular ring fracture from the convex radii to the diaphragm joint area.

Ladder: This is a horizontal fracture proceeding down the vertical side of the vessel wall. It resembles rungs on a ladder, and is commonly caused by a vacuum initiated backflow of cold condensate through a faulty check valve of the steam inlet. Condensate drips down the hot vessel wall causing damaging localized failure.

Note should be made that it is largely due to thermal stress factors that the standard thermal limitation data must be reduced by 23% for vessels greater than 4000 gallons, non-standard designs, e.g., double jacketed vessels and crystallization dishes. However, no reduction is required for the half pipe design.

The Need For Expanded Thermal Limits

For several years, it has been obvious to Pfaudler that the thermal constraints associated with the available Glasteels severely limited the processing freedom of chemical manufacturers. Most took on a mindset regarding these limitations and built their chemical campaigns to suit the material, often sacrificing thermal ranging capabilities for the many other benefits of Glasteel.

More recent kinetic research made it quite apparent that significant improvements on the rates of reaction, product yield and/or specificity of end product could be effected via higher or lower temperature processing.

Recognizing these facts, Pfaudler Research has now developed a new Glasteel, Ultra-Glas 6500™, to better address these important high temperature needs and has greatly expanded its knowledge base into the materials, design, and operation limits required for low temperature operation.

The New Glasteel Technology

The development of the Pfaudler Ultra-Glas 6500™ system and the acquisition of new date for low temperature operation was the result of the interactive efforts of several Groups within the Research Organization.

Ceramics: The computer was first used by Pfaudler in the late 1960's to develop the compositionally complex Glasteel® 3300. Software refinements were continually made during the development of Glasteel 5000 in 1979 and for the development of the new Ultra-Glas 6500. Careful attention has especially been made to the limitation chart (Figure 1), with compositional changes made to optimize the greatest spectrum of product

improvement. The important characteristics of both the ground and cover coat microstructure have now been specifically defined and again optimized especially through utilization of state-of-the-art instrumentation such as the Microtrac Lazer Light Diffraction Particle Size Analyzer and hot stage microscope. Concentrated efforts in the area of quality assurance, especially as regards awareness procedures and computer-based control instrumentation, from the frit manufacture through the finished product, has done much to reduce performance variability.

Metallurgy: This group has carried out interfacial kinetic studies between various metal/glass systems thereby allowing for a more complete understanding of adherence, especially as regards the difficult to glass low temperature metals. Joint studies with another well-known materials laboratory have provided better definition into the complexities associated with the fracture mechanics behaviour of metals at low temperatures. Other low temperature studies have indicated that SA516 Grade 70 can consistently test to -50°F.

Stress Analysis: Stresses and strains for any glass/metal system are very precisely determined using computer-driven Finite Element Analysis programs. Pfaudler uses "ANSYS PC/Linear" to accurately predict stresses anywhere in the reactor system resulting from hydrostatic, gravitational, thermal, etc. loading forces. With this valuable insight into the complex stress picture, corrective solutions, e.g., design, material, process, can effectively be made. Modeling systems can also be set up to mirror the exact strains existent in a chemical process campaign. Thus, potential problems can be identified and the appropriate corrective actions taken.

NEW SYSTEMS

Low Temperature

As reviewed earlier, the Metallurgy Group can now code test SA516 Grade 70 to -50°F with a full pressure/vacuum rating. Either the Glasteel 5000 or the new Ultra-Glas 6500 system can be used as the coating system. For temperatures to -200°F, two suitable options are available:

1) The 304, 316 Austenitic Stainless Steels. For these substrates, Glasteel 4000 is required. The corrosion resistance for most acids is 1.5x the rate for Glasteel 5000; for alkalis, the rates are comparable. The maximum allowable ΔT is 200°F compared to 260°F for Glasteel 5000.

2) *The Inconels.* These substrates can be used with the Glasteel 5000 system with a maximum ΔT of 260°F. A limiting factor with the Inconels is the substrate cost.

High Temperature

It is in the area of high thermal requirements that the new Ultra-Glas 6500 should provide significant benefits. Some pertinent comments follow:

1) The upper operating temperature has been expanded from 450°F to 650°F.

2) The allowable ΔT for the two most critical thermal shock situations (cases #1 and #4) has been increased up to 100°F for most media situations. Specifically:

Case #1 — 100°F ΔT improvement over Glasteel 5000;

Case #2 — same ΔT limits as Glasteel 5000;

Case #3 — same ΔT limits as Glasteel 5000;

Case #4 — the ΔT limit is dependent on the type of heat transfer media and the glasswall temperature. ΔT improvements up to 100°F over Glasteel 5000 can be achieved.

3) A corrosion rate comparison between Ultra-Glas 6500 and Glasteel 5000 follows:

CORROSIVE SYSTEM	CORRISION RATE (MILS/YR)	
	Ultra-Glas 6500	Glasteel 5000
20% HCl, BP, VP, ISO	1.6	1.7
Distilled H_2O, BP, VP, ISO	0.1	0.5
Distilled H_2O, 350°F, LP	6.3	9.4
Distilled H_2O, 450°F, LP	23.7	47.0
4% NaOH, 176°F, LP, ISO	11.7	10.9
20% H_2SO_4, 351°F, LP	17.9	15.9
80% H_2SO_4, 500°F, LP	0.4	0.5
70% H_3PO_4, 302°F, LP	8.9	8.5

BP = Boiling Point; ISO = International Organization for Standardization; LP = Liquid Phase; VP = Condensing Vapor Paste; % = Weight.

Field data also indicates that H_2SO_4 in concentrations greater than 80% and heating oils used as reaction media show very little visual damage to Glasteel 5000. Data acquisition for more chemical systems is continuing.

4) Programming in the improved allowable thermal differential of the Ultra-Glas 6500 to a computer simula-

n data base shows that heat up time reductions in the der of 20—30% are possible.

5) Over and above the numerous test units (up to 100 llons) made for data acquisition, there have been, to te, four reactors manufactured for field evaluation in e Ultra-Glas 6500 system, i.e. one 30 gal., two 300 l., one 2000 gal. Several more are in process. No pro-ems have surfaced with any of the field installations.

6) For continuous process cycling in the expanded ermal limit range, some vessel design modifications ay be needed. e.g. a modified bottom outlet nozzle, ppropriate insulation. The need for such modifications ust be addressed on an individual use basis.

7) Realizing that high temperature operation involves any accessory items that may weak-link the entire stem, Pfaudler has undertaken a concentrated search program to address these potential problems.

Gaskets: This is a continuing research area that for gh temperature end use (greater than 450°F) has cent-ed on both the envelope and insert material of the orig-ally patented Pfaudler CRT design. Appropriate metal velopes coupled with thermally stable, suitably resil-nt insert materials have now been developed that ould fill the majority of anticipated needs. Reliable imming techniques for these rather unique insert aterials have also been developed. For temperatures ss than 450°F, PTFE Teflon envelopes with the same ermally stable insert materials should suffice for the ajority of services.

Repairs: For temperatures in excess of 450°F, both e PTFE Teflon sealing/filler washers and the "F"/sil-ate filler should be replaced if permanence with ther-al cycling is to be achieved. To date, reliable three ece plug repairs up to 2.5" diameter have been devel-ed.

Paint: Two paints that show good resistance to both ermal degradation and acidic fumes have now been reened. Other systems with more universal corrosion sistivity are currently being evaluated.

Instrumentation: The Fault Finder, Temperatures Sensor, and pH Probe all have temperature limits lower than the upper operating temperature of the Ultra-Glas 6500 system. The Pfaudler Research Group is currently addressing this problem.

Other e.g., seals, drives, stuffing boxes, valves, agitating nozzles, etc. Each component must be carefully evaluated in terms of high temperature suitability especially from the standpoint of safety. There do not appear to be any insurmountable problems.

8) Potential areas of use. As higher temperature processing opens many innovative doors for chemists and chemical engineers, the exact areas of potential use are hard to define at this early date of development.

However, based on Pfaudler's past experience, along with customer inquiries, some areas that balance out favourably as regards thermal vs. corrosive performance include:

A) High temperature polymerizations;

B) Reactions using heating oils as the liquid media;

C) Sulfonations with sulfuric acid in weight concentrations greater than 80%;

D) Vapor phase reactions.

In discussing this new Glasteel development with Dr. Vladimir Hlavacek of the University of Buffalo, a world authority in the area of reaction engineering and the design of integrated chemical processes, he stated that "this expanded thermal versatility coupled with the already well-known chemical resistivity of Glasteel could greatly extend the use range of this valuable composite material."

He added that this development could be very useful in several areas in which he was currently working. i.e. containment of alkali salt eutectics for processing metallic/ceramic end products, containment of liquid sodium used as a metallurgical reducing agent, and for high pressure, high temperature leaching processes.

CHEMICAL WEEKLY

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PROFITABLE UTILISATION OF UNTANNED COLLAGEN WASTES FROM TANNERY

M.D. RANGANAYAKI
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During the processing of hides and skins into different types of leathers, huge quantities of byproducts such as hide/skin trimming, fleshing, hair, etc. become available at various stages of pretanning operations. These have to be disposed of by tanners as they cause environmental pollution. These proteinaceous solid wastes cannot be thrown away as they give obnoxious smell on putrefaction. Hence these wastes have to be disposed of for maintaining sanitary and hygienic condition in and around the tannery.

Lollar(1) has indicated that a significant portion of the hide become offal to be disposed of in one way or other. Hence the tanner has to tackle the problem of waste management on the principle of either carrying out waste prevention or waste reduction by suitably modifying the process or converting the waste into value added end products. Generally, tanners adopts the last mode of waste management, thereby he is able to create more employment opportunity, export promotion and import substitution of quality end products and also production of protein rich animal feed. It is found that during pretanning operation two types of proteinaceous wastes viz. keratin and collagenous wastes are generated. Since this paper deals on the profitable utilisation of collagenous wastes from tannery, this aspect alone will be highlighted.

It is wellknown that collagen is the basic protein of hide and skins. Since the collagen in untanned wastes is found in its native form with minimum decomposition and minimum change in its protein structure having less crosslinks it becomes a valuable raw stock for multivarious industries.

Utilization of collagen as a feed stock for glue and gelatin

The age old practice of using collagen in the manufacture of glue and gelatin can be cited as first and the foremost non-leather uses of collagen(2). The manufacture of glue & gelatin from untanned wastes is a well known process. The manufacture of gelatin is one of the most important method of liquidating untanned wastes because, the technology is simple, production is relatively cheaper with respect to investment and machinery. Glue and gelatin have a great demand in various industries.

It finds use as foodstuff due to its aesthetic and organoleptic appeal in food industry. It is also used in non-food areas such as photography, pharmaceutical, paper, textile and other industries. But, due to the advent of synthetic adhesives, the demand for glue from untanned wastes is fast declining. Hence, it becomes essential to explore the other areas where collagen can be used.

As a raw material for medical field

Chvapil(3) has documented extensively on the medical uses of collagen. Due to its inherent physical and mechanical properties it finds extensive use in medical areas as vessel prosthesis tubes, surgical sutures, non-woven fleece, just to name a few. Pharriss(4) has highlighted the use of collagen as biomaterial in its various form as solution in cell culture, as gel in vitreous body, as a fibrous material power, etc. One of the stringent requirement for medical product is that collagen should be sterile. However, the use of collagen in this area became limited due to the high degree of technology evolved in their manufacture despite, the high price fetched by collagen based medical products.

As a feedstock for artificial sausage casings

There have been a number of patents and papers on using collagen for edible casings production. McKenzie(5) has eleborately discussed the use of collagen for edible products other than gelatin. These artificial casings have been a major industrial product to replace natural casings made from cattle, sheep and goat intestines with the products having uniform quality, excellent shelf life and unlimited availability in all sizes. Since the production of artificial casings requires a very sophisticated technology and special types of equipments, the utilization of untanned wastes for this industry has become rather limited.

As a raw stock for fertilizer

The untanned wastes such as fleshing, trimming can be used as fertiliser. Feike(6) has mentioned that if the glue stock is carefully mixed with other appropriate wastes and allowed to undergo biological rotting, the composite thus formed can be used as fertilizer. The rendered hide scrapes and limed fleshing can also be used as fertilizer.

The only drawback found in its usage for this purpose is that they have to be buried deeply to mask their obnoxious odour during decay. Hence they cannot be used in booster doses for nitrogen during crop growing seasons but, can be added only prior to planting. They are no longer a competitive source for fertilizer in comparison to cheaper and better nitrification products available in the market.

As a source for synthetic leather

This is one of the uses of untanned wastes by the same industry which generates these wastes. The recent trend of using collagen fibres in the production of artificial leather is to blend the collagen fibres with manmade fibres resulting with the end product having the best properties of both viz. water vapour permeability and absorption of leather coupled with the durability of synthetic. Comte and Holt(7) have described in detail the method of production and properties of artificial leather such as colaten, collabayan, etc. The sheet made out of these leathers has facilitated machine handling thus leading to automation in shoe industry. The chief obstacle for artificial leather production is its high price due to cost of production of collagen fibres.

As a raw stock for animal feed

Of the above mentioned uses of a untanned waste, animal feed supplement has received the maximum attention. Pauckner(8) has developed a process for preparing protein in rich meal out of fleshings as a substitute for fish meal and soy meal. Natarajan **et. al.**(9) have developed a simple method of using limed fleshing as animal feed and have tested its role on growth by feed trial experiments on rats and chicken and have found that hide fleshing cannot be used as a sole source of protein in animal feed as they lack in some of the essential amino acids. However, it can be used as a partial replacement of standard protein to the extent of 25%. The fleshings can also be subjected to wet and dry rendering to yield animal feed. Since limed fleshings contain traces of sulfide, green fleshing is preferred for animal feed.

As a raw stock for pet food

Of late, there is a growing demand for processed food. This area of utilizing collagen based offals will fetch a high price to the tanners. Lime splits can be used for dog chews -- Schnell(10) and Lipsett(11) have elaborated the use of lime splits for the preparation of pets treats as an alternative use of untanned hide collagen.

As a raw stock for food

With rapidly growing population, the problem of feeding the human race has to be tackled by exploring various protein rich resources. Amongst them, the additional potentiality of hide collagen for human food has been explored by Henrickson **et. al.**(12). They have substituted wet fibrous collagen at various levels in coarse beef bologna, fine emulsion bologna, meat loaves etc. and incorporating air dried collagen in apple sauce cake, carrot cake, etc. As mentioned earlier, collagen being deficient in some of the essential amino acids it cannot be used as complete protein by itself and has to be supplemented in food preparation. Because of its unique biophysical properties, addition of collagen in food system improves the texture, has a moisturing effect and acts as emulsifier extender and filler.

As a feed stock for collagen based cosmetics

From the above, it is quite evident that for the leather industry, the disposal of solid wastes is a perennial problem, the solution of which is becoming more and more difficult. The present outlet for these untanned wastes to various industries for e.g. in the preparation of glue and gelatin is being threatened by the advent of competitive and cheap substitutes. Hence it calls for the development of alternative uses for these wastes to other new and potential industries in order to maintain a profitable market for them. Such a veritable drain in the wealth of nature, due to under utilisation of these wastes could be avoided by using them in sophisticated and high potential industry such as cosmetics.

Much literature has been documented on the use of protein based cosmetics(13). In recent years, the use of these products has gained an impetus through creative merchandise techniques coupled with wide array of cosmetic and toiletry products.

Though collagen based cosmetics are in vogue in the Western world, the technology of its manufacture still remains a secret, since most of the process are covered by patents. In order to create awareness amongst Indian public and entrepreneur on the very benefits

that collagen and its derivatives impart to cosmetic formulations and to suit Indian condition, a new technology has been developed by Central Leather Research Institute for the preparation of collagen derivative suitable for use in cosmetics formulation(14).

The performance of these products has been assessed by cosmetic consultants and beauticians and found to be equivalent to those available elsewhere. It has been found that when collagen based hair care products were used, they impart substantivity to the hair, render the hair more lustrous, soft, easy to comb, free from static electricity when dry and also improves its strength.

From the above mentioned end uses for untanned solid wastes to various potential and sophisticated industries, the tanner can adopt any of them which will fetch him high returns with less investment and thus wealth from waste could be made.

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LEATHER ABSTRACTS

FLAVONALS, FLAVONES AND TANNING OF *PARKIA CLAPPERTONIANA*, RD Adewoye and OO. A. Jayi, *J. Am. Leather Chem. Assn.*, **82** (5) 153, 1988.

The husk of *Parkia Cappertoniana*, a tropical plant belonging to the family of *Mimosaceal*, constitutes a significant potential source of Vegetable tanning agents. The tannin content is about 45%, mainly condensed tanning. Six flavorals, myricetin, quercetin, azaleatin, fisetin, Kaempforol and one flavone tricin, have so far been isolated from the material.

AIR FLOW TO MICROWAVE: THE CHOICE IS WIDENING, W. Landmann, *World Leather*, **1** (4) 13, 1988.

The technology of drying leathers has probably seen more fundamental innovations than any other leather making operations. Vacuum drying, automated toggling, high frequency drying and now microwave drying are some of the recent developments. This paper presents an account of the above methods and brings clarity to the situation.

WEARING WELL WORLDWIDE, David Tack, *World Leather*, **1** (4), 50, 1988.

The switch to making clothing leather has been perhaps the most significant global change for tanners this decade. The properties demanded of modern garment leathers include suitable substance for the intended use, suitable size of area to allow economical cutting and ease of manufacture into garments, and particularly high stick tear resistance and resistance to heat and organic solvents. They must have fashion appeal — colour, finish, texture, feel and a genuine leather appearance. This paper reviews suitable raw materials for clothing and recommends how to get the best from them in processing.

THE FUNDAMENTALS OF THE DYEING PROCESS AND ITS SIGNIFICANCE FOR THE PRACTICE, Bruno Hofer, *Leder and Haute Markt.*, **14** (14) 41, 1988.

A large quantity of leather with a nautural look is produced at present throughout the world. The surface of this kind of leather is scarcely or not at all coated with any pigment finish. Special importance is therefore, attached to the quality of the dyeing of this type of leather. This paper describes the investigations into the fundamentals on the dyeing process with a view to obtaining useful information on the practical work. Comparative tests were carried out with various groups of products to determine the factors to be considered in producing leather dyeings with high speed properties. The peculiar influence of dyeing auxiliaries is also discussed.

WATERPROOFNESS OF CHROME LEATHER FAT LIQUORED WITH MONO-ALKYL PHOSPHATE Kyoji Sato, *Hikaku Kagaku*, **33** (4), 211, 1988.

It has been found that the application of monoalkyl phosphates (MAP) fatliquors significantly increased the water resistance of chrome leathers. Highly pure MAP's having different chain lengths C8-C22 are prepared and applied to chrome leather. The water resistance of fatliquored leather was estimated by dynamic waterproofness and water absorption. The critical surface tension of leathers was determined by the sink-fleat method. The correlation between the water resistance and the critical tension was discussed.

NEW PRODUCTS & PROCESSES

ALL WATER FINISHING SYSTEM

A new all water system for finishing leather has been leveloped by ROHM Tech Inc. U.S.A. Involving three ase coat products and a top coat called TW-8901, it nables leather to retain its finish and pigmentation even fter dry cleaning including the use of perchlorethylene. he three base coat products are RE 494, a soft acque- us acrylic self-cross-linking dispersion; RE-8912, a esin binder which binds a solvent resistant acrylic co- olymer with polyurethane resin dispersions, and E 567 water-based dispersion. TW-8101, the PV Top Coat, chieves good levelling at low application levels of olids, resulting in a finer grain and a medium gloss finish iving flexibility and abrasion resistance.

NEW GLAZING FINISHING SYSTEM

Stahl has introduced EX 10332, a glazing oil applied o leather before the normal finishing binder. This results n excellent glass appearance, pull up and recovery roperties. The oil should be sprayed on to the leather and then left to stand for four to five hours before adding rotein season coats. The finish is finally fixed with for- maldehyde and glazed.

NEW FINISH DRYING CONCEPT

A fresh concept in finish drying of leather used by Vor- dale Ltd., U.K., in their Turvogas chyer, is said to give impressive results in the speed and quality of drying. A typical performance is the drying of leather in a 4500 mm dryer length after coating with 24 gms of water base finish per square metre. The concept involves the use of infrared radiation and high velocity air circulation.

POWER STICKER

A mechanical hide sticker for use during fasting is increasing yield and controlled consistency and it completes each hide in a minute. Developed by Central Research Laboratories of Red Wing, the device is a servo mechanical machine operated with a remote joy stick.

This is connected by a cable to an electronically controlled head and an eight inch wide stainless steel blade. The head and blade can move verticaly, horizontally, in-and-out and in a circle to cover an area of 68in. Blade pressure can be adjusted to suit the hides being pasted.

NEW FINISHING AUXILIARY

Bayer AG has introduced a new finishing auxiliary, Bayderm Fi PCL which improves the wet fastness, and in particular the wet rub fastness, of films made of dispersions of crosslinkable polyurethanes. It takes four to eight days for the product to become fully effective.

World Leather, (1) (4), 1988.

INDIAN LEATHER SCENE

EXHIBITION OF AMERICAN LEATHERS

A two-day exhibition of American leathers opened at Madras on 14th June, 1988. A wide variety of quality leathers besides shoes for men, women and children, reflecting American fashion trends were on display. It is hoped the exhibition will spur Indian leather goods makers to buy American leather.

The "American lifestyle leather exhibition" at Taj Coromandel Hotel has been organised by the Leather Industries of America (LIA) in conjunction with the Council for Leather Exports (CLE) India.

Inaugurating the exhibition, Mr. Raghy Dayal, Joint Secretary, Ministry of Commerce, said that the exhibition has opened up new possibilities for those in the leather industry in India and the U.S. to forge new partnerships for mutual benefit. The Indian Leather exporters would have to aim at substantially high value addition. The industry would have to think in terms of technical excellence, technological upgradation and high quality standards to be competitive. The Government had been able to give the industry a pragmatic policy packet to enable it to get leather from wherever it wanted through the OGL system. It would have access to equipment, components and consumables.

The easy recourse to imports need not always be a panacea, Mr. Raghy Dayal said and advised the industry to make optimal use of the recourses available in the country. The posibilities of replacing leather by substitutes without harming the interests of the industry would have to be thought of. He stressed the need to avoid wastage. A study by the CLRI showed that in 1986, the losses because of wastages and non-recovery of by-products were to the tune of Rs.583 crores.

He said it would not be difficult to take leather exports from $ one billion to $ five billion by the year 2000. Dr. John D. Stempel, U.S. Consul General, presiding, said the exhibition would further stimulate the two way India-U.S. trade relations. The two way trade which stood at $4.2 billions last year was expected to be raised to $6 billion in 1990.

Mr. M. Mohamed Hashim, Chairman, Council for Leather Exports, said the Council was preparing a detailed plan to achieve the $5 billion target for leather exports and pleaded for duty free import of goat and sheep skins.

Mr. Charles S. Myers, President, Leather Industries of America welcomed the gathering. Mr. Myers told a press conference that the leathers on display were of "excellent" quality for manufacturing particular types of products which the Americans want". Seven leading tanners from the U.S. were participating in the Exhibition.

CEILING ON SEMI-PROCESSED LEATHER EXPORT

The Commerce Ministry has announced the ceiling on the export of semiprocessed leather for the first six months of the current financial year. Consequently, till September 1988, exporters have been allowed a quantity of 29.69 lakh pieces comprising 19.49 lakh pieces of semifinished E.I. tanned (buff calf 2.45 lakhs, cow calf 2.09 lakhs, cow hide 2.21 lakhs, buff hide 13,750, sheep skin 5.63 lakhs and goat skin 6.98 lakhs) and 10.20 lakh pieces of wet blue goat skins.

The Ministry had earlier announced, as part of the new import-export policy, that limited quantities of semiprocessed leather exports would be allowed. The quantities pertaining to each category too has been indicated. It has also been said that the Joint Chief Controller of Imports and Exports, Madras would be the monitoring authority for exports of E.I. tanned leather, that is, buff calf, cow calf, cow hide, buff hides, sheep and goat skins and the Joint Chief Controller, Calcutta for wet blue goat skin.

It has also been announced that no applicant would normally be granted an export licence for more than 10% of the available ceiling in each category and the licensing authority would consider applications on the basis of the highest unit value sought to be realised and as quoted by the exporter in the application. The unit of measure would be on the basis of a lot of 100 pieces of irregular sizes to be quoted in Indian rupees f.o.b.

SUBDUED TREND IN HIDES SKIN MARKETS

A subdued trend prevailed in raw hides and skins market. In spite of poor supplies, prices of almost all

nds of hides, and skins except buff hides sustained esh losses in the absence of adequate buying sup-ort. Volume of business was moderate.

Reports that leather export targets have been stepped y Rs.300 crores to Rs.1,400 crores for current finan-ial year, failed to boost market sentiments because of rrivals, mainly consisting of inferior quality hides, which ttracted thin demand from local and upcountry buyers.

Cow hides: Activity in cow hides slacked on with-rawal of demand from West Bengal tanners. However, ellers were hesitant in disposing of their stock at educed prices. Volume of business was at lower levels. rices ranged from Rs.190 to Rs.320 per piece depend-ng on selection.

Dunger: Dunger sustained minor losses due to poor fftakes, though arrivals failed to pick up and supplies f selection varieties remained poor. Upcountry buyers voked moderate response for top selections, while ther varieties dropped on selling pressure. Prices anged from Rs.180 to Rs.310 per piece, depending on election.

Buff hides: Buff hides continued to rule steady with ncreased salt content, owing to poor receipts. There vas a fair level of inquiry from local tanners. However, rices showed little change, with 28/30 kg salt buff hides uled around previous level at Rs.4.00 per kg,while pick-ng band turned quiet at Rs.9.50, on lack of support.

Katal: Katai after recording initial gains turned easy n withdrawal of demand from Madras tanners. In spite f meagre arrivals prices tumbled down by Rs.2/3 to Rs.42/45 per piece. Current prices were lower by Rs.10/15 per piece, when compared with those prevail-ng a month ago.

Katta heavy: Light supplies attracted moderately teady inquiries and sellers realised slightly lower prices. With 7.50 kg salt, katta heavy was offered at Rs.7.25 er kg. Business was thin.

Goat skins: Goat skins recorded widespread losses due to poor offtakes due to improved supplies. Daily arri-vals were estimated around 1000/1200 pieces. These were lifted by Unnao-based tannery, which holds mono-poly in skins trade in north. Prices slipped by Rs.25/27 o Rs.42/45 per piece. Market is likely to rule sluggish, as quality of goat skins would deteriorate during rainy season.

Sheep skins: A distinctly easier trend was discern-ible in sheep skins which touched seasons low at Rs.40/42 per piece as against Rs.75/80 a month ago. The sharp decline in prices was mainly because of the lack of arrivals of superior selection varieties. Sheep skins lots was placed still lower at Rs.36/38 per piece.

SPURT IN LEATHER EXPORTS

The leather industry has undergone a seachange. Growth has been striking with the higher production and exports of value-added items.

Finished leather account for 39.04% of all shipments, while footwear components and leather footwear account for 26.01% and 10.28% respectively. The share of leather goods and garments is put at 9.20% and 8.49% respectively in 1987-88.

Exports of leather & leather products

Items	1986-87	1987-88
Semifinished leather	52.50	72.59
Finished Leather	400.89	485.97
Leather Footwear	80.38	128.03
Footwear	240.69	323.83
Components	62.27	105.72
Leather Garments	82.54	114.57
Leather goods Saddlery & harness	11.50	14.15
Total	**930.77**	**1244.86**

Aggregate exports of leather and leather products were only Rs.329.27 crores in 1980-81. They increased to Rs.436.04 crores in 1983-84, Rs.662.51 crores in 1985-86, Rs.930.77 crores in 1986-87 and further to Rs.1,244.86 crores in 1987-88. During 1987-88, aggregate exports of leather and leather products increased by 33.7% compared to 40.5% in the preceding year. An analysis of the export figures given in table above indicates that the leather garment sector, followed by the leather sector has maintained a high rate of growth.

The major factors that have been responsible for the spurt in export during 1987-88 were:

Rise in export of footwear, leather goods and garments to advanced countries like France, the U.S., the U.K, F.R.G. and Canada.

Increase in export of footwear components to the U.S.S.R., and U.S., F.R.G. and U.K.; and

Liberalisation in the import-export policy with refer-

ence to import of capital goods, components and consumables needed for the leather industry.

The Council for Leather Exports has fixed an export target of Rs.1,400 crores for 1988-89.

Though all types of leathers are allowed to be imported duty free under OGL upto crust stage, only bovine leather is allowed duty free in finished form. There has been a long-standing demand from the leather units to allow import of all types of finished leathers, including goat, sheep and pig, duty free, under OGL.

A serious problem being faced by the industry now relates to the export of leather goods by air. As leather goods are low density high volume products, it is necessary to ensure that goods are lifted maximum within a week and delivered promptly at the destinations.

In order to upgrade the low-grade hides & skins, import of PU films must be allowed at a reduced duty of 35% only, as is applicable to various chemicals. Though the Government has reduced the duty to 108% at present; a further reduction would augment raw material availability upto 150 million sq.ft.

To suit the needs of fashion-conscious customers, the industry has to upgrade itself. Adequate resources have to be allocated to the Central Leather Research Institute and tanneries to modernise their facilities.

HARMAN-SKOMAB CUTTING DIES

In recent years the Indian shoe and leather industry has become an important partner of the European shoe indutry. To date tools for the manufacture of shafts for the leather industry were imported into India. Due to organizational, administrative and last but not least financial reasons this procedure is no longer practicable. For these reasons the new company HARMAN-SKOMAB CUTTING DIES was founded in India. The Austrian partner, Skomab International, has introduced the double edged strip steel cutting knife to the shoe industry worldwide enabling the cutting of left and right parts with one cutting die. Skomab maintains two dieshops in Austria where besides cutting dies they also manufacture folding tools, embossing tools, HF welding tools etc. The Indian partner, Harman Sales Union is based in Bombay with branches all over India. The new venture is based in Madras.

For Further information, contact: Harman-Skomab Cutting Dies, 69, Devaraj Mudali Street, Triplicane, Madras-600 005.

SHORT IN ARM FOR LEATHER EXPORTS

India's exports of leather garments to the U.S. is likely to get a shot in the arm with the withdrawal of the provisions of the General System of Trade Preference (GSTP) as applicable to South Korea, Taiwan, Hong Kong and Singapore with effect from July, 1.

According to the Council for Leather Exports (CLE), now that preferential treatment to some of India's biggest competitors will have to go, Indian exporters would be better placed to enter the U.S. markets in a bigger way. Though the Federal Republic of Germany continued to be the largest customer of leather garments, of late exports to the U.S. has been on the upswing, which the Indian exporters are only too keen to tap.

Exports to the U.S. had gone up by as much as 65% in 1987-88, over that of 1986-87 from Rs.33.44 million to Rs.95.12 million. During the same period, exports to West Germany had gone up by 21% from Rs.315.68 million to Rs.445.52 million.

Total exports of leather garments from the country registered a phenomenal rise of 70%, from Rs.622.67 million in 1986-87 to Rs.1057.21 million in 1987-88.

However, one low point that was causing concern to the leather industry was the fact that exports of finished leather to France, U.K. and the U.S. had stagnated over the past few years. On the other hand, other importers, like Spain, Portugal and some South East Asian countries had increased their offtake from India but posed as a major competitor in the world markets for various value added products.

Regarding footwear components, CLE has pointed out that the Indian industry in the years to come would have to gear itself for meeting the changing perferences in countries like West Germany and U.S., which were gradually moving away from components and going in for complete shoes.

To achieve an export target of Rs.1400 crores during 1988-89, CLE has pleaded for several concessions from the Union Government including duty-free import of finished leather and reduction of import duty on PU films.

MARKET INFORMATION

We cannot guarantee the accuracy of the prices published in CHEMICAL WEEKLY as they are based only on the enquiries made by our correspondent — and, as such they are not FIRM PRICES as between a buyer and seller. The prices are published only with a view to giving some ideas of market conditions.

The prices are inclusive of Excise and Maharashtra Sales Tax.

Solvent prices up

Prices of basic industrial solvents such as Benzene, Xylene and Toluene shot up in the Bombay Chemicals Market due to shortage of commodities. However Phthalic anhydride moved downward to Rs. 17 per kg. Caustic soda moved up by Rs. 2. Tobias acid and Resist salt also moved upward. Prices of other intermediates also showed a slight uptrend.

(Prices as on 13th July 1988)

INDUSTRIAL CHEMICALS	Per kg.
Ammonium sulphate	2.00
Ammonium phosphate (Mono)	14.50
Ammonium phosphate (Di)	12.00
Ammonium carbonate (Di)	17.00
Ammonium bicarbonate	4.75
Ammonium chloride	3.00
Ammonium nitrate	3.50
Arsenic white powder	21.00
Acrylamide (Resale)	61.00
Barium carbonate	6.00
Bleaching powder (33% Cl)	4.00
Borax (Granular)	13.50
Borax (Powder)	20.00
Boric acid (Tech.)	21.00
Bisphenol-A	57+ST
Butyl carbitol	48.00
Caustic soda (Flakes)	9.20
Caustic soda (Solid)	8.00
Caustic soda (Lye)	7.00
Calcium chloride 70% (solid)	3.25
Calcium chloride 75-80% (fused)	3.50
Calcium chloride 36% (Anhydrous)	5.00
Calcium Carbonate PPT	3.00
Calcium carbonate (Activated)	3.55
Camphor (Indian)	82.00
Cresylic acid	50.00
Cream of Tartar (Tech.)	70.00
Citric acid (Belgium) (Resale)	43.00
Citric acid (Indian) (Resale)	42.50
Copper sulphate	17.50
Chromic acid	48.00
Cyanuric chloride	120.00
Cobalt oxide	280.00
Carbitol	55+ST

Dicalcium phosphate		56.00
Ethylene urea		7.00
Ferric chloride (Lumps)		16.00
(Anhydrous)		8.45
Glue flakes		6.75
Glue sheets		135+ST
Gohsenol GH-17		41.50+ST
Hydro	(Resale)	20+ST
Hyflosupercell		35.00
Hexamine	(Resale)	25.00
Industrial Wax		15.00
Litharge		28.00
Lead Acetate (Tech)		16.50+ST
Lithopone		1.00
Magnesium chloride (Crystal)		185+Ex.+ST
Menthol crystal (Flakes)		205+Ex.+ST
Menthol bold		245+Ex.+ST
Menthol crystal bold		16.00
Magnesium carbonate (Japan)		15.00
Magnesium carbonate (Indian)		
Maleic Anhydride (per kg)		45+ST
	(Resale)	10,500.00
Mercury (75 lbs.)		90.00
Nickel chloride		22.00
Oxalic acid	(Resale)	90+Ex.+ST
Peppermint oil (Rectified)		19.00
Potassium carbonate (Indian)		21.00
Potassium carbonate (Imported)		22.00
Potassium bichromate		14.00
Potassium phosphate (Mono)		14.00
Potassium phosphate (Di)		100+ST
Polyvinyl alcohol (No. 117)		
Polyvinyl alcohol (No. 173)		135+ST
	(Resale)	140.00
Polyvinyl alcohol (No. 208)		21.00
Paraformaldehyde (Resale)		
Phthalic anhydride 36%		24.00
	(Resale)	51.00
Pentaerythritol	(Resale)	14.50
Paraffin wax	(Resale)	80+ST
Rangolite (German)		54+ST
Rangolite (Czech.)		

Sodium sulphate (Fine)		6.00
Sodium sulphate (Coarse)		5.00
Sodium sulphide 50-52%		
(Flakes)		8.00
Sodium sulphide 58-60%		
(Flakes)	(TCL)	21.00
Sodium sulphide pure (Flakes)		12.25
Sodium nitrite	(Resale)	750.00
Sodium chlorite 80%	(Spain)	94.00
Santobrite (Indian)		36.00
Soda Ash (Tata)		4.00
Soda Ash (Birla)		3.80
Soda Ash (Imp.)		3.50
Sodium bicarbonate		5.25
Sodium bisulphite		4.50
Sodium silicate		3.00
Sodium acetate		6.00
Sodium alginate		140+ST
Titanium Dioxide (Anatase)		50+ST
Titanium Dioxide		
(Rutile — RCR_2)		69+ST
Tartaric acid (Crystal)		94.00
Trisodium phosphate		4.80
Thiourea		73+ST
Urea (Tech)		2.75
Vacuum salt		1.00
Zinc Dust		30.00
Zinc Oxide		30.00
Zinc chloride powder		
(technical)		14.00
Zinc sulphate		4.00

SOLVENTS		Per kg.
Acetic Acid (Glacial)	(Resale)	14.50
Acetic Anhydride	(Resale)	24.00
Acetone	(Resale)	15.00
Adipic Acid		55+ST
Aceto Acetanilide		50.00
Aniline Oil	(Resale)	50.00
Benzoate Plasticiser		45.00
Butyl Acrylate		95+ST

Butyl stearate		36.00
Butanol	(Resale)	34.00
Benzyl Alcohol		60.00
Benzyl chloride		34.00
Benzo trichloride		16.00
Benzoyl chloride		22.00
Bromine Liquid		42.50
Chloroform		25.00
Carbon Tetrachloride		16.50
Cellosolve		45+ST
Cyclohexanone		53+ST
Cyclohexanol		43+ST
Diacetone	(Resale)	35.00
Diethyl Oxalate		34.00
Diethylene glycol (DEG)		44+ST
Dioctyl Phthalate		52.00
Diallyl Phthalate		56.00
Dimethyl Phthalate		28.00
Dioctyl Adipate		52.00
Dibutyl Adipate		42.00
Dipentene		15.00
Dimethylamine 40%		12.00
Dimethylamine 60%		14.00
Ethyl Acetate		21.00
Ethyl Acrylate		49.00
Ethylene Dichloride		11.00
Ethylene Glycol		40+ST
Formic Acid (Imp)	(Resale)	29.00
Formaldehyde	(Resale)	6.00
Glycerine (CP)		53.00
Glycerine (IW)		48.00
Hydrogen peroxide 50%		
	(Resale)	28.50
Isopropyl Alcohol		17.50
Iso Butyl Alcohol		28.00
	(Resale)	30.00
Monoethanolamine	(Resale)	49.00
Melamine		58+ST
Methyl Ethyl Ketone		55.00
Methyl Isobutyl Ketone		36.00
Methyl Acrylate		42.00
Methyl Dichloride	(Resale)	23.00

Meta Cresol	46.00
Nitrobenzene	17.00
Nitric Acid (Con.) (RCF)	2.50
Ortho Cresol	30+ST
Phenol (Resale)	32.00
Propylene Glycol	41+ST
Polyethylene Glycol (No. 200)	39.00
Polyethylene Glycol (No. 400)	42.00
Polyethylene Glycol (No. 500)	42.00
Polyethylene Glycol (No. 1600)	14.00
Polyethyene Glycol (No. 4000)	38.00
Polyethylene Glycol (6000)	50.00
Para Cresol	40.00
Styrene monomer	50+ST
Sorbitol	16.50
Sulphuric Acid	2.10
Trichloroethylene	27.00
Triethanolamine (Resale)	49.00
Turpentine Oil (Germany)	8.00
Turkey Red Oil (50%)	11.75
Triethylamine	50.00
Vinyl Acetate Monomer	43.30

SOLVENTS	Per Litre
Benzene	12.00
N-Heptane	8.00
N-Hexane	8.75
Methanol	7.00
Solvent Naphtha Heavy	10.50
Solvent Naphtha Light	8.50
Toluene	12.00
Xylene	16.00

DYES INTERMEDIATES (PRICES ARE WITHOUT TAX AND EXCISE)	
Alphanaphthylamine	60.00
Alpha Naphthol (Imp.)	180.00
Aceto Acetic Ester (Methyl)	60.00
Ammonium Molybdate	200.00
Anthraquinone	95.00
Anthranilic Acid	60.00
2-Amino-4-Nitrophenol (Imp.)	155.00
Blue B. Base (Local)	230.00
Beta Naphthol (Atul)	58.00
Benzidine Dihydrochloride (BDH)	80.00
Bromamine Acid	400.00
BON Acid	112.00
Chicago Acid	280.00
Coach Acid	56.00
C. Acid (Imp.)	260.00
Cyanuric Chloride (Japan)	120.00
2, 4, DNCB	29.00
Dihydrothio PTOS (Imp.)	600.00
Dimethyl Aniline	70.00
Diethyl Aniline	160.00
Di-amino stilbene disulphonic acid	125.00
3, 3-DCB (Imp.)	180.00
Gamma Acid (Atul)	170.00
H. Acid (Atul)	155.00
G. Salt	60.00
Isophthalic Acid	45.00
J. Acid	265.00
J. Acid Urea	280.00
K. Acid	100.00
MDPS (German)	200.00
MNA	90.00
Meta Unido Aniline	160.00
MPD (Local)	135 + EX + Tax
MPD (Japan)	200.00
Naphthenic Acid	12.00
N-Methyl J. Acid	380.00
N-Methyl Aniline	115.00
Naphthalene (Refined)	23.00
Ortho Anisidine (OA Imp.)	85.00
Ortho Dichloro Benzene (ODCB)	11.25
OT Base	98.00
Para Dichloro Benzene (PDCB)	16.00
Para Anisidine (PA-Imp.)	110.00
Para Anisidine (PA-Local)	90.00
PNA	70.00
Para Cresidine (Imp.)	335.00
Para Amino Azo Benzene (India)	125.00
PNCB	31.00
Para Amino Acetanilide	145.00
1-Phenyl 3-methyl-5 Pyrazolone	120.00
Phenyl J. Acid	345.00
Para Amino Benzoic Acid	170.00
PT Base	88.00
Rhoduline Acid	500.00
Resist Salt	22.00
Resorcinol	145.00
Sodium Naphthionate	65.00
5-Sulpho-Anthranilic Acid	64.00
Sulphanilic Acid	25.00
Sulpho Tobias Acid	113.00
Trichloro Benzene (TCB)	17.00
Tobias Acid	122.00

Bombay dyes market

(Prices as on 13th July, 1988)

ACID COLOUR	Per Kg.
Acid Violet 4BS	143.00
Acid Maroon V	110.00
Acid Orange II	77.80
Acid Orange IIY	63.05
Acid Red A	107.25
Crosein Scarlet MOO	155.00
Acid Scarlet 3R	99.90
Acid Red 38N	135.00
Acid Red R2R	132.00
Acid Red RS	88.00
Acid Green V	230.00
Acid Patent Blue AS	250.00
Acid Coomasi Blue	200.00
Acid Yellow 5GN	65.00
Acid Red PG	85.00
Acid Red GRS	78.00
Acid Black 10 BX	121.95
Acid Black BX	98.40
Acid Black Wax	135.50
Procinil Yellow GS (ICI, UK)	265.00
Procinil Red GS (ICI, UK)	530.00
Procinil Blue RS (ICI, UK)	315.00
Procinil Scarlet G (ICI, UK)	600.00
Procinil Orange G (ICI, UK)	250.00
Procinil Rubine (ICI, UK)	550.00

DIRECT COLOURS	Per Kg.
Yellow 3GX	88.10
Gun Yellow RCH	124.00
Fast Yellow GCH	141.15
Yellow CFG Hly. Conc.	312.00
Fast Yellow GS	111.65
Fast Yellow CHRS	95.45
Viscose Orange A	166.15
Fast Orange GR	133.75
Red	96.90
Dark Tan	78.25
Red IIR	72.55
Red 4B	169.10
Bordeaux BW	132.30
Fast Scarlet 4BS	166.55
Red 12B	170.55
Bordeaux Hly. Conc.	194.00
Cotton Red N	117.05
Brill. Fast Helio B	278.00
Brill. Fast Helio 2B	297.00
Brill. Fast Helio 2RS	136.20
Brill. Fast Helio BS	116.10
Brill. Violet Extra	126.40
Blue 2B	86.60
Blue G	170.50
Sky Bue FB	188.25
Copper Blue GR	147.00
Fast Greenish Blue GL	114.60
Developed Black BT	116.10
Blue NB-2B	300.20
Blue NB-2BC	185.30
Developed Black NB-GHB	185.30
Green B	111.65
Green NB-B	188.25
Green 2B-N	188.25
Brown MR	154.40
Brown CN	107.25
Golden Brown G	140.35
Catechin G	120.50
Omega Tan	126.40
Catechin GS	102.80
Black E Hly Conc.	142.60
Black E Extra Hly. Conc.	142.60
Black NB-ER Hly. Conc.	310.50

DISPERSOL COLOURS	Per Kg.
Yellow 6G Powder	143.80
Red B 3B Powder	247.80
Red B 2B Powder	323.20
Red CB Powder	439.15
Red D2B Powder	477.40
Violet C 4R	521.90
Blue BG Powder	235.45
Blue BN Powder	103.75
Blue D 2R Powder	476.25
Navy BT Powder	243.90
Blue B 2G Powder	210.20
Black BT Powder	182.60
Blue BR Powder	390.20
Yellow 7GL	338.60
Yellow 5RX	218.80
Yellow 3G	367.25
Yellow	140.00
Yellow AL	135.30
Yellow Brown REL	247.50
Yellow FFL	463.60
Gold Yellow GG	239.70
Pink REL	247.00
Red REL	468.65
Red 2B	327.40
Red FB	324.20
Red Violet FBL	469.85
Orange 3R	196.65
Violet 3R	280.00
Violet RL	275.45
Violet 6R	485.75
Scarlet RR	214.80
Rubine 3B	223.00
Rubine CB	364.90
Blue GL	318.90
Blue BGF	636.50
Navy Blue RF	270.40
Brown 3REL	200.40
Black GEL	324.20
Dark Brown 3B	317.40

BASE COLOURS	Per Kg
Fast Yellow GC	80.20
Fast Orange GC	135.45
Fast Scarlet R	166.90
Fast Scarlet RC	126.65
Fast Scarlet RCR	99.05
Fast Scarlet G	121.65
Fast Scarlet GN	91.50
Fast Scarlet GG	72.70
Fast Scarlet GGS	72.75
Fast Red B	203.20
Fast Red RC	119.15
Fast Red R Flakes	149.25
Fast Red TR	166.80
Fast Red TR Oil	183.15
Fast Red RL	237.10
Fast Red KB Oil	201.95
Fast Bordeaux GP	201.95
Fast Garnet GBC	94.00
Fast Violet B	505.65
Fast Blue BB	521.40

NAPHTHOL COLOURS	Per Kg
ASG	217.00
AS	143.00
ASSW	279.75
ABBS	189.15
ASBO	195.65
ASD	175.50
ASOL	179.35
ASTR	279.75
ASPH	279.75
ASE	196.05
ASEI	184.40
ASLB	1632.60
ASBT	1817.05
ASWG	143.00
ASSG	397.75
ASSR	480.50

ROCION COLOURS	Per Kg.
olden Yellow HR	181.80
rill. Yellow H4G	117.85
upra Yellow H-8GP	168.55
rill. Yellow HE6G	166.95
ellow H-E4R	276.05
rill. Yellow H7G	332.30
ellow M4R	243.95
ellow M GR	326.05
rill. Yellow M4G	177.10
rill. Yellow M8G	332.30
ellow M 3R	217.60
rill. Orange H 2R	241.85
rill. Red H 7B	157.95
rill. Orange M 2R	313.15
rill. Red H 8B	169.45
rill. Scarlet H RN	245.05
upra Red H-3BP	179.30
rill. Red H-F3B	243.45
rill. Magenta HB	167.00
rill. Red M 5B	98.90
rill. Red M 8B	173.70
rill. Pink MB	137.10
rill. Magenta MB	121.55
rill. Purple H-3R	180.20
rill. Purple H-7R	175.40
Navy Blue H 3R	298.50
rill. Blue H-GR	366.55
rill. Blue H 5G	173.10
Blue H 5R	283.85
rill. Blue H 7G	178.70
rill. Blue H 7RX	358.15
Turquoise HA	234.45
Supra Blue H-3RP	335.70
Supra Turquoise H 2GP	181.50
Blue H-ERD	305.80
Navy Blue H ER	258.60
Blue H 5RX	269.30
Navy Blue M 3R	310.95
Brill. Blue MR	331.70
Brill. Blue M RX	214.20
Brill. Blue M-G	382.30
Blue M 4GD	344.60
Navy Blue M RB	318.75
Turquoise M-G	197.85
Brill. Blue M GX	302.50
Blue 3R Acra Powder	718.20
Dark Brown H 6R	248.45
Cobalt Oxide (per kg.)	285.00
Green H 4BD	269.80
Green H-E4BI	169.80
Red Brown H 1F	143.25
Orange Brown H 28	209.05
Brown M GRN	188.80
Black H-N	283.35

SULFUR COLOURS	Per Kg.
Navy Blue	99.85
Green G	198.55
Black Grains Extra	63.05
Black Grains OG	64.55
Black GXE Conc.	61.60
Black GXE	52.75
Black GXR	61.60
Black Grains 800	54.20
Black EXR Grains	64.55
Black EXR Grains 800	51.25

VAT COLOURS (ICI)	Per Kg.
Yellow 5G Powder Fine	673.15
Yellow 5G Supra Disperse	439.30
Yellow 5G Acra Con.	628.75
Yellow 3R Powder	588.85
Gold Orange 3G Pdr. Fine	952.15
Brill. Orange 6R Pdr. Fine	624.35
Gold Orange 3G Supra Disp.	601.30
Brill. Orange 6RX Powder	394.30
Brill. Red 3B Pdr. Fine	997.80
Brill. Red 3B Supra Disp.	713.20
Brill. Purple 4R Conc. Pdr.	470.75
Brill. Purple 3R Acra Powder	690.85
Brill. Purple 2R Hly Conc.	597.90
Brill. Purple 4R Supra Disp.	500.05
Brill. Purple 2R Acra Conc.	625.95
Blue R Powder Fine	542.15
Blue BC Conc. Pdr. Fine	522.50
Blue BC Acra Conc. Pdr. Fine	762.70
Blue R Conc. Pdr. Fine	577.65
Blue RR Supra Powder	629.35
Blue Conc. Powder	645.80
Brill. Blue 2R Hly. Conc.	378.55
Brill. Blue 2R Supra Disp.	115.65
Dark Blue 2R Powder Fine	389.25
Blue BC Supra Disp.	359.40
Jade Green XBN Powder Fine	438.20
Jade Green XBN Acra Conc. Powder	823.90
Jade Green 2G Pdr. Fine	419.65
Jade Green 2G Ptg. Faste	125.40
Jade Green XBN Ptg. Paste	126.00
Jade Green 2G Supra Disp.	496.00
Olive Green B Pdr. Fine	399.90
Olive D Pdr. Fine	444.30
Olive Green B Supra Disp.	308.25
Jade Green XBN Supra Disp, (N)	327.30
Olive OMW Pdr. Fine	698.55
Olive OMW Supra Disp.	538.05
Olive R. Pdr. Fine	422.96
Olive D Supra Disp.	361.70
Olive R Supra Disp.	363.90
Olive D. Ptg. Paste	193.00
Olive Green B. Ptg. Paste	199.10
Olive Green B Acra Conc.	542.75
Olive R Acra Conc.	640.00
Olive Green B Acra Conc.	542.75
Brown R Pdr. Fine	835.00
Brown G. Pdr. Fine	795.00
Brown R Pdr. Fine	659.75
Dark Brown 3R Pdr Fine	685.00
Brown G. Supra Disp.	449.90
Brown 2G Supra Disp.	554.00
Brown R Supra Disp.	422.95
Brown BR Powder	719.00
Dark Brown 3R Ptg. Paste	217.15
Dark Brown 3R Supra Disp.	414.55
Brown G Acra Conc.	733.95
Brown R Acra Conc.	766.00
Grey M. Powder Fine	768.80
Grey M. Supra Disp.	585.45
Blue BC Acra Conc. Pdr. Fine	762.70
Direct Black AC Supra Disp.	330.35
Direct Black AC Pdr. Fine	474.70
Direct Black CH Supra Disp.	393.20
Direct ACD Ptg. Paste	217.15

Delhi Market

DELHI : JULY 15, (NNS) — Mercury recorded a handsome gain of Rs. 500 per flask in the local chemicals market during last week, on negligible stock position, says NNS. Copper sulphate and zinc oxide also rose modestly, while tartaric acid dropped sharply at Rs. 175 on lower Bombay advices. Turnover was normal.

A sharp increase of Rs. 700 at Rs. 10,400 per flask by MMTC recently, mercury jumped up sharply by Rs. 500 at Rs. 11,000 per flask on higher Bombay on negligible stock position in the market. In the first week of May mercury was quoted at Rs. 9800 per flask.

Copper sulphate hardened sharply by Rs. 100/200 at Rs. 2100/2300 on increased production cost caused by increased prices of raw materials. Zinc oxide, flared up sharply by Rs. 2000/3000 at Rs. 35,000/40,000 per tonne owing to high rates of zinc metal. Carbon Tetrachloride and hydrogen peroxide and glycerine prices edged up by Rs. 1/2 at Rs. 20, Rs. 30/31 and Rs. 44/45 per kg, respectively on tight stock and fall in supply.

Sufolight moved up by Rs. 2 at Rs. 50 per kg. followed by hike its prices by manufacturers. Chatkolight in 40 kg. packing edged up by Rs. 2 at Rs. 47, while in 50 kg. packing it was ruled static at Rs. 48.50. Sodium hydro sulphite Gulshan turned easy by Rs. 1 at Rs. 38 per kg. on poor sale due to rainy weather.

Ammonia bicarb hardened by Rs. 5 at Rs. 125 per 25 kg. on increased seasonal consumption by bakeries. Caustic soda flake went up by Rs. 2 at Rs. 405/406 per 50 kg. on tight supply and higher rates and increased mutual speculation by manufacturers.

Menthol flake, medium and bold dropped by Rs. 3/8 at Rs. 197, Rs. 210 and Rs. 217 per kg. thanks to persistent offerings from U.P. but at the weekened in the face of tight supply from U.P. due to rains and increased demand by stockists it rallied and looked up by Rs. 3/6 at Rs. 200, Rs. 215 and Rs. 223 per kg Mentha oil advanced by Rs. 3 at Rs. 160. Tartaric acid suffered a steep fall of Rs. 175 at Rs. 6,100 per 50 kg. followed by lower advices from Bombay whereas the commodity being offered lower at Rs. 6000. Offtake was also negligible. Napthalene balls slipped by Rs. 50 at Rs. 1350 in the absence of demand by local and outside traders. Titanium dioxide Anatase eased by Rs. 1 at Rs. 49 on scattered selling. Formic acid rose smartly by Rs. 45 at Rs. 870 per 50 kg. owing to hike its prices by manufacturers.

No appreciable change was recorded in dyes and colours on thin trading.

(DELHI MARKET RATES AS ON JULY 15, 1988)

Ammonia Bicarb (per 25 kg)	125.00
Mercury (per flask)	11,000.00
Soda ash (per bag)	270-300.00
Ammonium chloride (per 50 kg)	125-180.00
Caustic soda solid	No Stock
Caustic soda flakes (per 50 kg)	405-406.00
Citric acid (per 50 kg)	2050-2400.00
Stable Bleaching Powder Shriram (per 25 kg)	95.00
Stable Bleaching Powder KCI (per 25 kg)	85.00
Stable Bleaching Powder MODI (per 25 kg.)	90.00
Sod. Bicarbonate (per 50 kg)	260-270.00
Sod. Hydro Sulphite (per kg)	38-42.00
Rangolite (per kg)	47-70.00
Boric acid Technical (per 50 kg)	1020.00
Paraffin wax (per 50 kg)	625.00
Tartaric acid (per 50 kg)	6,100.00
Borax Granular (per 50 kg)	575.00
Borax Crystal (per 50 kg)	600.00
Sodium Nitrate (per 50 kg)	450.00
Sodium Nitrite (per 50 kg)	725-750.00
Camphor Powder (per kg)	87.00
Camphor Thal (per kg)	97.00
Menthol Medium (Per kg)	200.00
Menthol Flakes (per kg)	215.00
Menthol Bold (per kg)	223.00
Glycerine (per kg)	44-45.00
Sodium Silicate (per quintal)	200-250.00
Hexamine (per kg)	42.00
Acetic Acid Glacial (per kg)	13-13.50
Copper Sulphate (per quintal)	2100-2300.00
Formic acid (per kg)	25-26.00
Formaldehyde (per kg)	8.00
Hydrogen Peroxide (per kg)	30-31.00
Calcium Carbonate (per tonne)	2500-4000.00
Acid Slurry Soft (per kg)	24.00
Acid Slurry Hard (per kg)	32.00
Phosphoric Acid (per 50 kg)	870.00
Pot. Nitrate (per quintal)	900-1200.00
Pot. Permanganate (per 50 kg)	2300.00
Sod. Bichromate (per 50 kg)	1050-1150.00
Tri-Sod. Phosphate (per 50 kg)	350-380.00
Titanium Dioxide Anatase (per kg)	49.00
Titanium RC-822 (per kg)	63.00
Zinc Oxide (per mt)	35,000-42,000.00
Phenol Carbolic Acid (per kg)	33.00
Carbon Tetrachloride (per kg)	20.00
Chloroform (per kg)	28.00
Sodium Sulphate (per 50 kg)	160-170.00
Naphthalene Balls (per 50 kg)	1350.00

DYES & COLOURS	per kg
Naphthol AS	150.00
Naphthol ASG	235.00
Naphthol ASBS	200.00
Naphthol ASTR	302.00
Naphthol ASOL	191.00
Naphthol ASBO	208.00

DIRECT DYES	(per kg)
Black E. Conc.	92-155.00
Diazo Black B.T.	125.00
Green B.	119.00
Blue 2-B	86.00
Sky Blue FB	200.15
Basic Auramine	55-100.00
Basic Rhodamine B.500%	220-320.00
Basic Methylene Blue	92-130.00
Basic Violet	142-160.00
Basic Malachite Green	160-185.00
Acid Orange	45-52.00

Madras Market

Markets were quiet during the week. There were good enquiries for stable bleaching powder following temporary suspension of production by MCIC due to chlorine shortage. The supply position of caustic soda has also become critical on account of withdrawal by Tamil Nadu Electricity Board the additional power sanctioned to industries during non-peak periods. Diethylene Glycol prices spurted on account of acute shortage. Acetone prices went up marginally due to stabilisation of prices by manufacturers.

(MADRAS MARKET RATES AS ON JULY 16, 1988)

Acetic Acid — Glacial (per kg)	17.50
Acid Slurry (Soft) (per kg)	27.00
Aluminium Sulphate Iron free (per tonne)	1,800.00
Ammonium Bi-carbonate (per 25 kg.)	125.00
Ammonium Chloride SPIC (per tonne)	2,500.00
Bleaching Powder — Mettur (per 25 kg bags)	125.00
Borax Granular	650.00
Cresylic Acid 98/99% (per kg)	88+E.D.
Meta Cresol 40/42% (per kg)	39.00+E.D.
Para Cresol 80/85% (per ton)	60+E.D
Caustic Soda Flakes (Mettur) (per ton)	8,600.00
Caustic Soda Flakes (Andhra Sugar)	8,600.00
Citric Acid — Indian	
Copper Sulphate (per kg)	48.00
(per 50 kg)	1000.00
Formic Acid (India) (per kg)	27.00
Formaldehyde (per kg)	9.00
Glycerine (per kg)	45.00
Hydrosulphite of Soda TCPL (per kg)	43.00
Hydrosulphite of Soda IDI (per kg)	45.00
Hydrosulphite of Soda BASP (per kg)	45.00
Hydrogen Peroxide (India) (per kg)	30.00
Hyflo Supercell	19.50
Magnesium Carbonate Light	18.00
Potassium Bichromate (per kg)	28.00
Phosphoric Acid (per kg)	18.00
Phthalic Anhydride (per kg)	25.00
Pentaerythritol (per kg)	52.00
Paraffin Wax (per kg)	13.50
Oxalic Acid (per kg)	22.00
Soda Ash (TAC) (per 75 kg)	316.00
Soda Ash (TATA) (per 75 kg)	320.00
Sodium Cyanide Indian (per kg)	58.00
Sodium Cyanide Degussa (per kg)	80.00
Sodium Bichromate (per kg)	18.00
Sodium Bicarbonate (per 50 kg)	280.00
Sodium Nitrite (per 50 kg)	750.00
Sodium Nitrate (per 50 kg)	450.00
Sodium Silicate (per tonne)	4500.00
Sodium Sulphate (per tonne)	3500.00
Sodium Sulphide Flakes (per tonne)	13,000.00
Sodium Bi-sulphite (Aswin) (per MT)	3,800.00
Stearic Acid (per kg)	32.00
Trisodium phosphate (per 50 kg)	380.00
Titanium Di-oxide Indian TTP (per kg)	48.00
Titanium Di-oxide Indian Rutile (per kg)	58.00
Urea Tech (per tonne)	2,800.00
Zinc Oxide (per kg.)	34.00
Zinc Chloride Powder (per kg.)	13.00
Zinc Sulphate (per tonne)	4,500.00
Di-octyl phthalate (per kg)	44.00
Di-butyl phthalate (per kg)	44.00
Hexamine (per kg)	32.00

SOLVENTS

Acetone (IOC) (per kg)	18.50
Isopropyl Alcohol NOCIL (per kg)	23.00
Diacetone Alcohol NOCIL (per kg)	29.00
Benzene SAIL (per kg)	15.00
Diethylene Glycol NOCIL (per kg)	50.00
Butanol NOCIL (per kg)	34.00
Toluene SAIL (per litre)	13.00
Xylene IPCL (per litre)	15.00
Phenol HOC (per kg)	28.00
Turpentine (per litre)	16.50
Sorbitol (per kg)	35.00
Trichloroethylene MCIC (per kg)	23.50
Carbon Tetra Chloride (per kg)	16.00
Chloroform (per kg)	26.00
Methylene chloride (per kg)	25.00
Methyl Ethyl Ketone (per kg)	45.00
Cellosolve (per kg)	50.00
Triethanolamine (per kg)	23.50
Ethyl Acetate (per kg.)	22.00
Butyl Acetate (per kg)	44.00
Methanol (per litre)	10.00

MATERIALS IMPORTED

BOMBAY
(From 9-2-88 to 15-2-88)

ACRYLAMIDE: From Japan : Ashok Dye-Chem., 1,020 kgs., Rs. 21,851; Fibro Chem Indus., 2,000 kgs., Rs. 40,248; LN Chemical Inds., 3.000 kgs., Rs. 60, 372; From Netherlands : PDI Chemicals Pvt. Ltd., 1,300 kgs., Rs. 25,317: From Japan: Synthetic Dyes & Chemicals., 2,040 kgs., Rs. 43,702.

ALDEHYDE C-10: From Netherlands: Fine Fragrances Ltd., 1,350 kgs., Rs. 233.

ALDEHYDE C-12: From Netherlands: Fine Fragrance Ltd., 900 kgs., Rs. 392: From Switzerland: Rangrugandh Agarbathies 10 kgs., Rs. 5,536

AMYL GLYCOLATE: From Netherland: Oriental Aromatics, 25 kgs., Rs. 18,088

ALUMINIUM OXIDE SYNTHETIC: From FRG: Advani Oerlikon Ltd., 3,000 kgs., Rs. 1,14,117.

DL-2- AMINOBUTANOL : From FRG: Lupin Labs P. Ltd., 30,420 kgs., Rs. 27,88,532; Medche & Chemicals And Pharma., 15,600 kgs., Rs. 17,21,579.

1-AMINO-4-METHYL PIPERAZINE: From Sweden: Lupin Labs Pvt. Ltd., 1,020 kgs., Rs. 6,48,-903.

ANILINE OIL: From UK: Bayer India Ltd., 38.400 Mts., Rs. 5,-13,513.

AROMATIC CHEMICALS : From Netherlands: Oriental Aromatics 1,750 kgs., Rs. 2,78,555.

ARSENIC TRIOXIDE: From Korea: Iberia Organics Pvt. Ltd., 50,000 kgs., Rs. 3,22,330; Jamnadas Madhavji & Co., 25 Mts., Rs. 1,61,609.

BENZALDEHYDE: From USA : Ravi Chem Dyes , 16,270 Mts., Rs. 3,73,890.

BENZYL ISO EUGENOL: From Japan: Oriental Aromatics, 50 kgs., Rs. 31,744.

BETA PICOLINE: From Belgium: FDL Pvt. Ltd., 1,900 kgs., Rs. 59,820; From Belgium: Metroni Drugs Pvt. Ltd., 4,940 kgs., Rs. 1,47,516; Unique Pharmaceutical Laboratories, 5,130 kgs., Rs. 1,53,189.

BISPHENOL-A: From FRG : Panchsheel Paints, 1,000 kgs., Rs. 23,370.

N BUTANOL: From FRG: Asha Nitrocellulose P Ltd., 15,600 kgs., Rs. 1,68,107.

BUTYL ALCOHOL: From FRG: Aquapharm Chemicals Co., Ltd., 6,800 kgs., Rs. 75,480.

BUTYL GLYCOL: From FRG: Asian Paints India Ltd., 7,215 kgs., Rs. 95,530; Jayant Oil Mills., 7,215 kgs., Rs. 95,530, From UK: SRSK Chemicals, 14-430 kgs., Rs. 1,59,243.

BUTYL TITANATE: From Indonesia: Mohinder & Co., 1,000 Rs. 38,950.

CALCIUM CYANAMIDE: From FRG: Shri Abhyuda Chemicals Pvt. Ltd., 200 kgs., Rs. 2,852.

CALCIUM FERROCYANIDE : From FRG: Citurgia Biochemicals Ltd., 10,000 kgs., Rs. 2,52,588.

CALCIUM FLUORO PHOSPHATE: From USSR: The S.T.C. of India Ltd., 14,800 kgs., Rs 7,54,275.

CAPROLACTAM: From Belgium: J. K. Synthetics Ltd., 222 Mts., Rs. 54,47,511; J. K. Synthetics Ltd., 319.5 Mts., Rs

7,89,999; J. K. Synthetics Ltd., 177.5 Mts. Rs. 43,55,555. From Denmark: Signpolia Bros., 222 Mts., Rs. 54,47,511; From Spain; J. K. Synthetics Ltd., 300,000 kgs., Rs. 71,66,752; Modipan Ltd., 500,000 kgs., Rs. 1,21,86,-680; From Sweden: Bharat Heavy Electricals Ltd., 300,000 kgs., Rs. 71,66,752.

CHOLESTEROL USP: From Netherlands: Metro Exporters Pvt. Ltd., 100 kgs., Rs. 53,621.

CHOLINE CHLORIDE 50% FEED GRADE: From Belgium: Unichem Inds., 11,600 kgs., Rs. 1,29,521; From USA: American Embassy, 11,600 kgs., Rs. 1,29,-521.

CIS 3 HEXENYL ACETATE: From Netherlands: Oriental Aromatics, 50 kgs., Rs. 72,352.

CIS 3 HEXENYL SALICYLATE: From Netherlands: Oriental Aromatics, 100 kgs., Rs. 99,845.

CITRONELLOL REGULAR: From Netherlands: Fine Fragrances Ltd., 225 kgs., Rs. 32,951.

CLOVE BUD OIL USP: From Netherlands: Fine Fragrances Ltd., 4.5 kgs., Rs. 2,985.

CLOVE OIL DD: From USA: Asian Paints India Ltd., 3,000 kgs., Rs. 3,24,700.

CRESYLIC ACID: From FRG: Dr. Beck & Co. Ltd., 1,48,000 kgs., Rs. 22,38.313.

DIBUTYL MALEATE: From FRG: Siddhivinayak Chemicals Pvt. Ltd., 15,600 kgs., Rs. 3,36,-838.

DICHLORO ISO CYANURIC ACID SODIUM SALT: From Japan: Punjab Wool Combers Ltd., 1,360 kgs., Rs. 75,396.

DICHLORO NITROBENZENE. From FRG: Sudarshan Chemical Inds., 6,000 kgs., Rs. 2,44,440.

3, 4 DICHLORO NITRO BENZENE: From FRG: Sudarshan Chemical Inds., 6,000 kgs., Rs. 2,44,440.

DICYANDIAMIDE: From FRG C. D. Corporation, 5,000 kgs., 1,32,405.

DIETHYL ALUMINIUM CHLORIDE: From USA: Indian Petrochemicals Corpn. Ltd., 12.4 Mts., Rs. 9,16,472.

DIETHYLANILINE HIGH PURITY: From USA: Gujarat Narmada Valley Fertilizers, 27,760 kgs., Rs. 7,13,621.

DIETHYL CARBAMOYL CHLORIDE: From FRG: Chemipharm Chemicals & Pharm., 1,900 kgs., Rs. 1,37,709.

3, 2 DIETHYL-2,4 DIOXO-TETRAHYDROPYRIDINE: From Switzerland: Roche Products Ltd., 1,600 kgs., Rs. 10,95,065.

DIMETHYL BENZYL CARBINYL ACETATE: From Netherlands: Fine Fragrances Ltd., 18 kgs., Rs. 3,331.

DIMETHYL BENZYL CARBINOYL ACETATE: From Netherlands: Fine Fragrances Ltd., 18 kgs., Rs. 3,331.

DIETHYLENE GLYCOL MONO ETHYL ETHER: From Hong Kong: SRSK Chemicals, 4,750 kgs., Rs. 52,420.

DIMETHYL DICHLOROSILANE: From FRG: Concord Pharmaceuticals Ltd., 5.040 kgs., Rs. 1,88,903.

DIMETHYL FORMAMIDE: From Japan: Searle India Ltd., 3,800 kgs., Rs. 50,323.

DIOCTYL PHTHALATE: From FRG: Sharma Electronics Works, 8,000 kgs., Rs. 87,378.

1,4 DIOXANE: From Japan: Indian Dyestuff Indus. Ltd., 2,000 kgs., Rs. 51,532.

DIPHENYL OXIDE: From USA: Nirma Chemical Works Pvt. Ltd., 15,513.12 kgs., Rs. 3,22-257.

DIPHENYL METHANE DI-ISOCYANATE: From FRG: Gargi Metallurgical Corp., 10 Mts., Rs. 2,85,631.

DIPROPYLENE GLYCOL: From Netherlands: Fine Fragrances Ltd., 4.455 kgs., Rs. 152.

ETHYLENE ACRYLIC ACID: From USA: Essel Packagings Ltd., 4,600 kgs., Rs. 1,25,418.

ETHYLENE GLYCOL MONO ETHYL ETHER: From UK: BASF India Ltd., 14,820 kgs., Rs. 1,76,482; Dhirajlal & Co., 11,020 kgs., Rs. 1,31,231.

ETHYL HEXANOIC ACID: From FRG: Tata Exports Ltd., 3,040 kgs., Rs. 55,733.

2-ETHYL HEXYL ACRYLATE: From FRG: Keytro Chemicals Ltd., 12,780 kgs., Rs. 2,47,230.

2-ETHYL HEXYL PEROXY DI CARBONATE: From FRG: Indian Petrochemicals Corpn. Ltd., 4,-800 kgs., Rs. 7,90,833.

FERRIC CHLORIDE SOLUTION: From Iraq: Delux Enterprises, 59 kgs., Rs. 510; From UK: Indox Chemicals Ltd., 59 kgs., Rs. 510.

FERRIC OXIDE YELLOW: From FRG: Parke Davis (India) Ltd., 100 kgs., Rs. 9,211.

FLUOBORIC ACID: From UK: Infolcentre Pvt. Ltd., 1 Mt., Rs. 3,755.

FORMAMIDE: From FRG: S.D. Fine Chem Pvt. Ltd., 1,150 kgs., Rs. 25,768.

GAMMA FERRIC OXIDE: From FRG: Garware Plastics & Polyester Ltd., 875 kgs., Rs. 58,462; Hansa Overseas Enterprises, 875 kgs., Rs. 58,462.

GLYCERINE: From FRG: Colgate Palmolive (I) Ltd., 83,200 kgs., Rs. 13,50,258.

GLYCERYL TRIACETIN: From UK: Precision Rubber Inds., 2,880 kgs., Rs. 98,088.

GUM ARABIC: From Nigeria: International Commercial Ent., 20,000 kgs., Rs. 1,55,799.

GUM COPAL: From Indonesia: Konark Paint & Chemicals, 3,850 kgs., Rs. 25,213.

GUM ROSIN: From Australia: Rajasthan Petrosynthetics Ltd., 18 Mts., Rs. 1,25,029; From China: Coates of india Ltd., 36 Mts., Rs. 2,50,992; Rohit Pulp & Paper Mills Ltd., 18 Mts., Rs. 1,25,029; Sarvodaya Resin Works, 49,950 kgs., Rs. 3,24,-257; UK Paint Inds., 49.91 Mts., Rs. 3,33,717; From FRG: Metaiman Pipe Mfg. Co. Ltd., 5.850 Mts., Rs. 40,786; From Japan: Murari Woollen Mills Pvt. Ltd., 6.3 Mts., Rs. 43,923; From UK: Desai Wire Inds., 5.850 Mts., Rs. 40,786; From USA: Asian Paints India Ltd., 12.150 Mts., Rs. 84,710.

GUM TRAGACANTH POWDER: From UK: Warner Hindustan Ltd., 200 kgs., Rs. 1,33,452.

HELIOTROPIN: From Japan: Asian Chemicals Works Ltd., 120 kgs., Rs. 41,286; Oriental Aromatics, 150 kgs., Rs. 48,005.

HELIOTROPIN : From Denmark: Sign Polio Bros., 2,400 kgs., Rs. 9,90,926; From Japan: Hindustan Lever Ltd., Rs. 2,400 kgs., Rs. 9,90,926.

HELIONAL: From Netherlands: Oriental Aromatics, 50 kgs., Rs. 46,124.

HEXACHLORO CYCLO PENTADIENE: From USA: Bharat Pulverising Mills P. Ltd., 40,000 kgs., Rs. 9,03,634.

HEXAHYDRO HEXAMETHYL CYCLOPENTA BENZOPYRAN : From Netherlands: Fine Fragrances Ltd., 18 kgs., Rs. 6,566.

HEXAMETHYL DISILAZANE : From FRG: Cepham Laboratories Ltd., 3,100 kgs., Rs. 4,79 918.

HYDRAZINE HYDRATE 80%: From France: Sun Exports Corpn., 16,000 kgs., Rs. 12,94,689.

HYDRAZINE HYDRATE 100%; From JAPAN: Hindustan Ciba Geigy Ltd., 2000 kgs., Rs. 80,-496.

HYDROSULPHITE: From USSR; Optik Lens, 2200 kgs., Rs. 29,991.

HYDROTROPIC ALDEHYDE: From Netherlands: Fine Fragrances Ltd., 2.700 kgs., Rs. 400.

IODINE CRUDE 99.5% USP: From Japan: Kirti Chemicals, 1000 kgs., Rs. 2,33,699; Lub Cut Incorporation, 1000 kgs., Rs, 2,33,699.

ISOBORNYL ACETATE: From FRG: Dujodwala Udyog Ltd., 25 Mts., Rs. 3,77,813.

ISOBORNYL CYCLOHEXANOL: From Japan: Berlia Aromatics Pvt. Ltd., 1,800 kgs., Rs. 1,89,062.

ISOPHTHALIC ACID: From Japan: Bakelite Hylam Ltd., 17,800 kgs., Rs. 2,11,065; Revex Plasticisers Pvt. Ltd., 5,500 kgs., Rs. 73,551.

ISOPROPYL ALCOHOL: From Taiwan: Alpesh Chemical, 14.7 Mts., Rs. 1,16,769; From USA: Amar Preet Enterprises Pvt. Ltd., 39.312 Mts., Rs. 2,94,060.

LACTOSE: From FRG: Glindia Ltd., 18,000 kgs., Rs. 2,20,745; From Netherlands: May & Baker (India) Ltd., 8,000 kgs., Rs. 95,793; M. J. Exports Pvt. Ltd., 11 Mts., Rs. 1,32,114.

LITHIUM BROMIDE ANHYDROUS: From FRG: Glindia Ltd., 500 kgs., Rs. 1,09,591.

LITHIUM CARBONATE TECH.: From USA: S. K. Chemicals Ltd., 1.361 Mts., Rs. 62,904.

LYRAL: From Netherlands: Fine Fragrances Ltd., 18 kgs., Rs. 4,942.

MALEIC ANHYDRIDE: From FRG: Khatau Junker Ltd., 15.6 Mts., Rs. 2,34,945; From Japan: Khatau Junker Ltd., 17,500 kgs., Rs. 2,13,574.

MANNITOL USP: From France: Albert David Ltd., 7 Mts., Rs. 1,72,677; From Brazil: Hindustan Ciba Geigy Ltd., 7,000 kgs., Rs. 1,49,957.

META TOLUENE DIAMINE CRUDE: From Japan: M. B. Finance Corpn., 3,000 kgs., Rs. 1,11,371.

METHYLENE CHLORIDE: From UK: Priya Chemicals, 56,592 kgs., Rs. 3,93,825.

METHYL ETHYL KETOXIME: From Japan: U.K. Paint Inds., 2,470 kgs., Rs. 89,618.

METHYL ISOEUGENOL: From Netherlands: Fine Fragrances Ltd., 27 kgs., Rs. 8,929.

2 - METHYL NAPHTHALENE: From FRG: Poly Bond Pharmaceuticals, 1,000 kgs., Rs. 58,-664.

N-METHYL PYROLIDONE: From FRG: S. D. Fine Chem Pvt. Ltd., 420 kgs., Rs. 25,666; From USA: Century Enka Ltd., 625.98 kgs., Rs. 37,818.

MICROCRYSTALLINE CELLULOSE: From USA: Rallis India Ltd., 460 kgs., Rs 30,945.

MICROCRYSTALLINE WAX: From Spain: Harjit Singh & Bros., 42 Mts., Rs. 2,10,654.

MONOCHLORO ORTHO PHENYL PHENOL: From UK: Nath Peters Pharmaceuticals Co., 1 Mt., Rs. 65,653.

MONOETHYLENE GLYCOL: From Japan: Amar Preet Enterprises Pvt. Ltd., 18,330 kgs., Rs. 1,40,750.

MONOMETHYLATED ACETAMIDE: From FRG: Hindustan Ciba Geigy Ltd., 1,08,780 kgs., Rs. 20,05,489.

NAPHTHALENE CRUDE: From Canada: Kamdham Agro Chem Inds., 48 Mts., Rs. 2,99,134.

NAPHTHENIC ACID DISTILLED: From Romania: Aman Enterprises, 3,150 kgs., Rs. 45,993.

NITRIC ACID: From FRG: Mafatlal Inds. Ltd., 32 kgs., Rs. 255; From UK: Indon Chemicals Ltd., 32 kgs., Rs. 255.

NITROMETHANE: From USA: Ranbaxy Laboratories Ltd., 2,270 kgs., Rs. 1,56,202.

O-NITRO TOLUENE: From FRG: Liberty International Ltd., 14,400 kgs., Rs. 56,088.

ORGANO TIN PESTICIDES - TRIBUTYL TIN OXIDE: From USA: Aquapharm Chem Co. Pvt. Ltd., 440 kgs., Rs. 65,466.

PARA FORMALDEHYDE: From Spain: Himalaya Resins & Paints P. Ltd., 5 Mts., Rs. 28,564; PDI Chemicals P. Ltd., 5,000 kgs., Rs. 31,484; Tata Exports Ltd., 16,000 kgs., Rs. 91,402; From USSR: The STC of India Ltd., 9,990 kgs., Rs. 50,325.

PARAXYLENE: Reliance Inds Ltd., 1,494.211 Mts., Rs. 78,17,-266.

PERCHLOROETHYLENE: From Belgium: Anshul Chemicals P. Ltd., 20,412 kgs., Rs. 1,55,033; Prohbexs Aids, 20.469 kgs., Rs. 1,42,116.

PHENOL: From USA: Rahul International Marketing, 15.230 Mts., Rs. 1,37,849.

PHENOL USP: From USA: Hindustan Magcobar Chemicals, 25.2 Mts, Rs. 3,59,895.

PHENOXY ETHYL ISOBUTYLATE: From Switzerland: Rangsugandh Agarbathies, 200 kgs., Rs. 20,130.

POLYBUTYLENE TEREPHTHALATE RESIN: From Japan: MCE Products Sales Service Ltd., 2,000 kgs., Rs. 84,731.

POLYETHYLENE GLYCOL: From UK: Sandvik Asia Ltd., 500 kgs., Rs. 22,289.

POLYVINYL ALCOHOL: From Japan: Kalva Chemicals Pvt. Ltd., 1,000 kgs., Rs. 22,072; Kalva Chemicals Pvt. Ltd,. 15 Mts., Rs. 3,31,074; Piramal Spg. & Wvg. Mills Ltd., 2 Mts., Rs. 44,143; Sharda Synthetics (Bom) Pvt. Ltd., 2,000 kgs., Rs. 41,546. From Taiwan: Supreme India International, 14,500 kgs., Rs. 2,91,,799.

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N. PROPANOL: From USA: Gujarat Themis Biosyn Ltd., 13,200 kgs., Rs. 2,31,361.

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SUCRALFATE: From China: Micro Labs P. Ltd., 1,000 kgs., Rs. 1,65,490.

SULPHUR: From UAE: Grasim Industries Ltd., 4,000 Mts., Rs. 62,23,016.

SYNTHETIC RESIN: From USA: Bansilal & Son, 719 kgs., Rs. 35,617; Manish Surfactants Ltd., 17,000 kgs., Rs. 10,42,244.

TARTARIC ACID: From France: Sharda Dyeing & Printing Works, 10,000 kgs., Rs. 4,44,-838.

THIOUREA: From FRG: JKBM Ltd., 5,000 kgs., Rs. 1,23,016.

TITANIUM DIOXIDE: From Spain: P. K. Diamond, 85,000 kgs., Rs. 21,63,009.

TITANIUM DIOXIDE RUTILE: From Finland: Goodlass Nerolac Paints Ltd., 80.000 kgs., Rs. 20,66,933.

TOLUENE DI ISOCYANATE: From Belgium: Nufdam Inds., 18,000 kgs., Rs. 5,02,451; From FRG: Anand Organic Pvt. Ltd., 5,000 kgs., Rs. 1,39,570; From USA: Chemie Nova Inds. Pvt. Ltd., 19,000 kgs., Rs. 5,15,665.

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